CHANGING RIVER

CHANGING RIVER:
Time, Culture, and the Transformation of Landscape in the Grand Canyon

A Regional Research Design for the Study of Cultural Resources
along the Colorado River in lower Glen Canyon and
Grand Canyon National Park, Arizona

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In memory of Gisela E. Fairley
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HCF

EXECUTIVE SUMMARY

The Grand Canyon Protection Act (GCPA) of 1992 specifies that Glen Canyon Dam will be operated "in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including, but not limited to natural and cultural resources and visitor use" (Public Law 102-575). The GCPA also requires long-term monitoring of and research on the effects of dam operations and specifies involvement of Native American tribes and other stakeholders in the adaptive management of Glen Canyon Dam. Another federal law, the National Historic Preservation Act (NHPA) of 1966, as amended, requires federal agencies to "take into account the effect" of their "undertakings" on historic properties eligible for listing in the National Register and, to the extent possible, to mitigate the adverse effects of those undertakings. To assist in fulfilling these legal mandates, the U.S. Geological Survey's Grand Canyon Monitoring and Research Center requested proposals for the development of a research design that could be used as a framework for prioritizing cultural resources in the Colorado River ecosystem (CRE) below Glen Canyon Dam for future data recovery and other forms of "treatment." This document is the result of that request.

In the recent past, cultural resource research, mitigation, and monitoring in the CRE has been hampered by several unresolved political and philosophical issues: (1) lack of agreement among the Bureau of Reclamation, the National Park Service, and other involved parties about the significance of the cultural resources in the CRE; (2) lack of agreement about what constitutes appropriate treatment and data recovery at cultural sites; (3) lack of agreement concerning the scope and extent of the physical effects of dam operations on cultural resources; and (4) fundamental differences between Native American tribal views and western scientific perspectives concerning the definition of cultural resources, the values associated with those resources, and their appropriate treatment. This research design was prepared with these issues in mind and attempts to resolve them through the use of a landscape-anthropology framework.

Landscape anthropology articulates the dialectical nature of diverse processes that are traditionally categorized as either "cultural" or "natural." In landscape anthropology, the natural/cultural dichotomy is replaced with a perspective that views natural and cultural processes as mutually reinforcing and interacting through time. Rather than viewing human culture as an adaptative mechanism reacting to a shifting environmental stage or viewing nature as a force that operates upon and shapes human cultures, the landscape approach encourages the study of human cultures as evolving, dynamic components of larger dynamic ecosystems.

By applying a landscape framework, diachronic human behavior and the dynamic riverine ecosystem are examined as interdependent components of a single evolving ecosystem. This framework is well suited to the integration of historical and contemporary cultural information with physical and biological data, all cornerstones of the current Glen Canyon Dam Adaptive Management Program (GCD-AMP). Furthermore, the landscape approach allows for the exploration of the intangible realms of human ideology and cognition by using a combination of tangible material evidence and ethnographically derived information. The landscape approach seems most appropriate in light of the diverse cultural interests attached to the Grand Canyon and expressed through the broad spectrum of stakeholder values included in the GCD-AMP.

The research design is organized into seven chapters. Chapter 1 provides general background information and explores the political and philosophical issues surrounding the management of and research on cultural resources in the CRE. Next, Chapter 2 summarizes current environmental conditions and provides a synopsis of what we know about past environmental settings in the CRE. Chapter 3 summarizes previous ethnographic, historical, biological, and archaeological research undertaken in the Grand Canyon region, with a particular emphasis on past archaeological research within the river corridor. Native American perspectives about the significance and cultural importance of the Grand Canyon and the Colorado River to affiliated tribes are highlighted in Chapter 4. Chapter 5 brings together diverse archaeological opinions about Grand Canyon's human story, with the aim of highlighting key points of agreement and dispute as well as significant knowledge gaps. In Chapter 6, we present the theoretical basis for using a landscape approach to organize future research efforts in the Grand Canyon, summarize topics and specific questions that can be addressed within a landscape framework, and identify appropriate methods and future data needs. Chapter 7 attempts to reconcile the landscape approach with NHPA-compliance requirements, defines a new landscape-oriented site typology for archaeological properties in the CRE, and offers several points for consideration by interested tribes and agencies when determining future treatment options within the Grand Canyon river corridor.

The heart of this research design is Chapter 6. This chapter is organized into three broad topics of inquiry: land, people, and landscape. The first topic, land, is concerned with identifying research issues and approaches that can help us understand how the physical and biological setting of the Grand Canyon river corridor has evolved and changed through time as a result of both natural and cultural processes. Under the first topic, we explore the geophysical, paleoclimatic, and biological parameters that have (1) shaped the landscape of the inner Grand Canyon over time, (2) influenced choices made by humans as they attempted to adapt and cope with the dynamic riverine ecosystem, (3) responded to human-induced change, and (4) transformed the archaeological record into the remnants we see today.

The second topic, people, is concerned with the explicitly human dimension of the CRE. It is specifically focused on the definition of cultural entities and the distribution of cultural materials and patterns in space and over time. In this section, several traditional archaeological research themes are explored: (1) chronology of human occupation and material culture, (2) cultural identities, (3) subsistence and settlement strategies, and (4) exchange.

The third topic, landscape, investigates natural and cultural realms as mutually reinforcing and interacting components of an integrated ecosystem to which humans have applied meaning and value over time. Under this third topic, we examine themes relating to changing soiocultural boundaries and interactions through time, cultural transformations, and systems of communication and ideology manifested in the archaeological landscape. This final section provides a bridge between studies of past human relations with the land and present-day perceptions and values. It also provides a basis for discussing and evaluating the research values of archaeological sites in a context that is compatible with the concept of traditional cultural places.

In many cases, the basic data necessary to formulate meaningful hypotheses are still lacking. Therefore, a large portion of Chapter 6 is devoted to highlighting the types of information needed to address long-standing research issues in Grand Canyon human history. General discussions of appropriate field methods and data analysis strategies are also included.

This research design is not exclusively concerned with data recovery involving the excavation of archaeological sites. Although it certainly can be used to frame excavation-based research, it also identifies data gaps and research questions that can be addressed through the use of nonexcavation research strategies such as Geographic Information Systems (GIS)-based analyses of existing survey information, surface-artifact analyses, and oral history inquiries. With creativity and flexibility, this research design can be applied to a broad array of future research undertakings in the river corridor, not just archaeological excavation projects to meet NHPA-compliance requirements.

CHAPTER 1

Introduction

In the arid terrain of the American Southwest, the Colorado River is an anomaly. Originating in the highest reaches of the Rocky and Wind River Mountains and transecting the heart of the vast, rugged Colorado Plateau, this snowmelt-fed river forms a linear oasis more than 1,400 miles long that sustains a diverse assortment of plants and animals, some of which are found nowhere else in the world. As the largest perennial stream in the region, draining an area of approximately 244,000 square miles, the Colorado River has provided an essential source of sustenance for humankind since people first traversed this high desert plateau more than 12,000 years ago. In the course of interacting with this river and its canyons, people have invariably left their mark upon the land in the form of trails, shrines, dwellings, quarries, irrigation ditches, fields, glyphs, and a variety of other human modifications to the landscape. In turn, the river and its canyons have indelibly marked the human psyche.

This research design highlights the many different ways in which humans and the Colorado River landscape have interacted and intertwined their destinies over the centuries. It provides direction for future research at archaeological sites and other types of cultural resources that can help us comprehend the complex web of relationships that have developed during the past 12,000 years of human occupation on the Colorado Plateau. This document is specifically intended to guide future research at archaeological sites in the river corridor in Grand Canyon National Park and Glen Canyon National Recreation Area that may be impacted by the operations of Glen Canyon Dam (Figures 1 and 2). Future studies are necessary to fulfill the compliance requirements of the National Historic Preservation Act (NHPA) and the research and monitoring requirements of the Grand Canyon Protection Act. It is hoped that this research design will also prove useful to National Park Service (NPS) managers, who, as part of their daily duties, manage and mitigate the impacts to cultural resources in the Colorado River corridor that result from visitor use and administrative activities.

This chapter provides an introduction to the research design project, explaining why it is necessary, describing the history of events leading to its development, identifying the primary stakeholders, and reviewing some of the key issues it attempts to address. Subsequent chapters describe the environmental setting of the river corridor, previous research in the study area, and traditional tribal perspectives on the Grand Canyon; provide a summary of culture history (as currently understood by archaeologists); identify differing archaeological perspectives on Grand Canyon human history; and ultimately offer an outline of research gaps and needs, along with a framework for prioritizing cultural sites for future research.

Background

In October 2000, the Grand Canyon Monitoring and Research Center (GCMRC) issued a request for proposals (RFP) (No. 01WRPA00020) to prepare a research design and treatment prioritization plan for archaeological sites and other cultural properties located within the area of potential effect (APE) from operations of Glen Canyon Dam. The RFP identified two primary objectives:

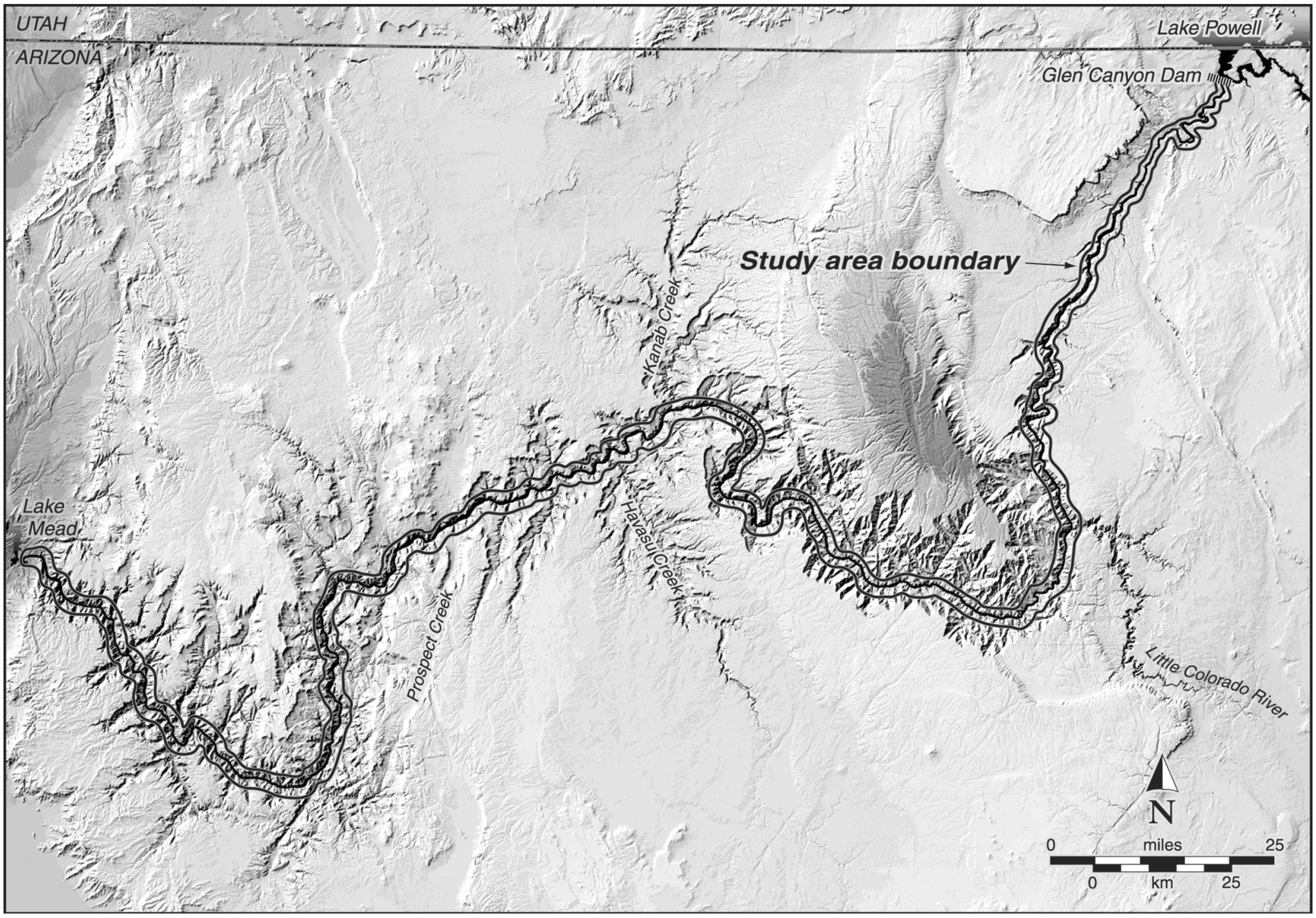

Figure 1. Map of the study area.

1. Provide research domains and research questions that are relevant to river-specific research, with links to larger regional contexts; and
2. Provide a framework for the treatment of all cultural resources.

This RFP was created in response to several needs that had emerged as a result of more than a decade of research and monitoring of cultural resources in lower Glen Canyon and Grand Canyon. These studies were initially funded through the Bureau of Reclamation's (Reclamation) Glen Canyon Environmental Studies (GCES) Program between 1989 and 1994. After the Grand Canyon Protection Act was passed in 1992 and the Record of Decision for the Glen Canyon Dam Environmental Impact Study was issued in 1996, the Glen Canyon Dam Adaptive Management Program was established, along with GCMRC. Studies pertaining to effects of dam operations on the cultural resources of the Colorado River corridor are now supported by the U.S. Geological Survey (USGS) GCMRC cultural program, with hydropower revenues funneled through Reclamation.

As summarized in Chapter 3, ad hoc archaeological studies have been going on in the Colorado River corridor below Glen Canyon Dam for many decades, but it was growing public concern during the 1980s over possible effects of dam operations on the downstream ecosystem that resulted in the funding of a comprehensive inventory and assessment of cultural sites in the river corridor. Between 1989 and 1991, with money provided to NPS by Reclamation, a program of intensive inventory and research was conducted in the Colorado River corridor below Glen Canyon Dam (Fairley et al. 1994). Initially, the Grand Canyon River Corridor (GCRC) archaeological program focused on two primary objectives: (1) to identify all archaeological sites located in the Colorado River corridor below Glen Canyon Dam that could be susceptible to impacts from the operations of Glen Canyon Dam, and (2) to assess the geomorphological setting of the archaeological sites and their future susceptibility to erosion. The objective was to develop an appropriate management strategy for the continued preservation of the sites.

Although the geomorphological studies continued until 1995, after 1992 the focus of cultural resource studies in the river corridor shifted from inventorying to mon-

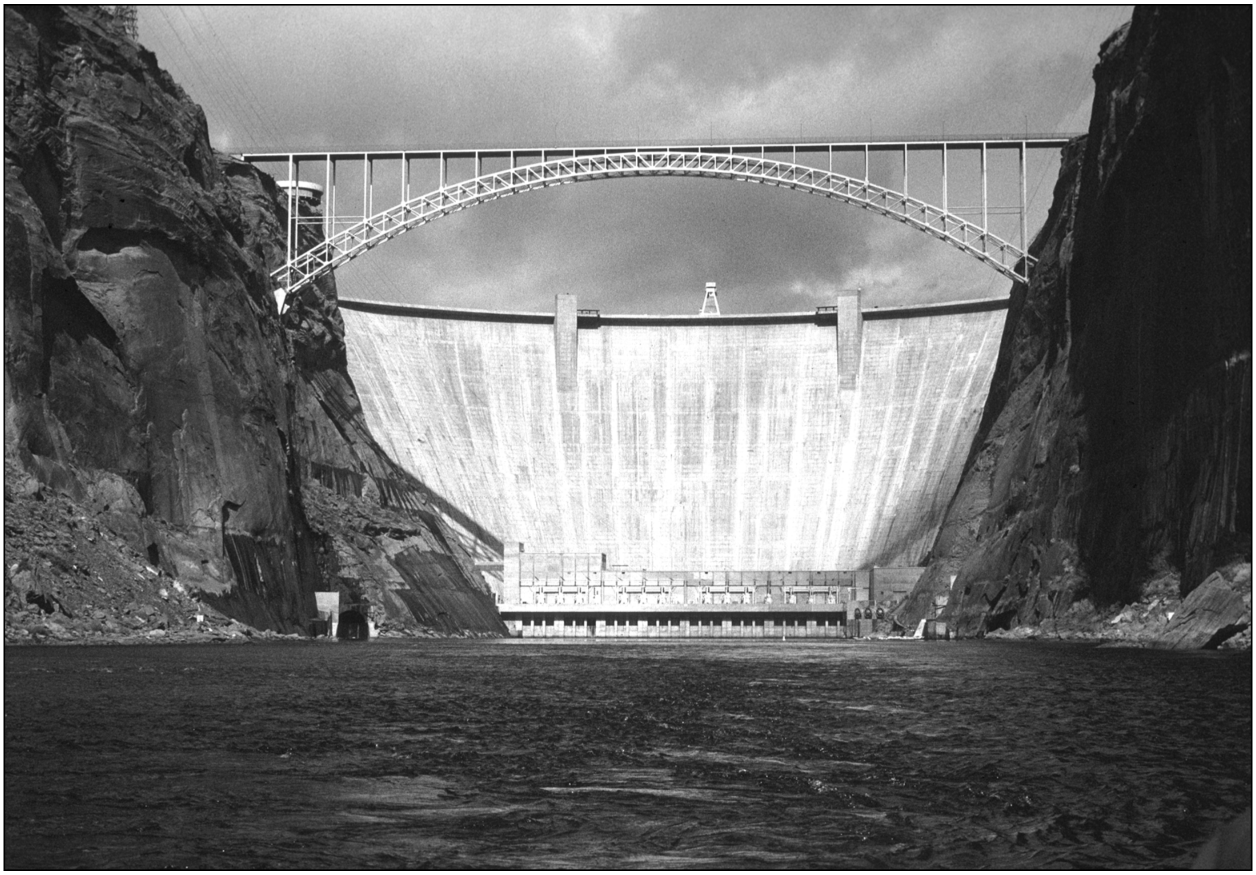

Figure 2. Glen Canyon Dam (photograph by Richard Hereford).

itoring impacts to the archaeological sites (NPS 1994). In conjunction with the monitoring effort, some sites were subsequently identified by NPS archaeologists as needing stabilization or data recovery. Since 1993, numerous small-scale data recovery (testing) and stabilization projects have been undertaken at select sites (e.g., Dierker and Downum 2002; Leap 1994, 1995; Yeatts 1998, 2000). This emphasis on monitoring cultural resources and conducting remedial activities continues to the present day.

At about the same time that the archaeological inventory program got underway, the NPS and Reclamation initiated consultation with eight traditionally affiliated tribes in the Grand Canyon region: the Havasupai Tribe, the Hopi Tribe, the Hualapai Tribe, the Navajo Nation, the Kaibab Band of Paiutes, the San Juan Southern Paiute Tribe, the Paiute Indian Tribe of Utah (on behalf of the Shivwits Band of Southern Paiutes), and the Pueblo of Zuni. Following considerable discussion among the tribes, NPS, Reclamation, the Arizona State Historic Preservation Office (SHPO), and the Advisory Council on Historic Preservation (ACHP), it was determined that there was a need for a programmatic agreement (PA) to facilitate and structure the federal agencies' responsibilities for complying with Section 106 and 110 of the NHPA. After participating in initial discussions, the Havasupai and the San Juan Southern Paiutes chose not to continue active involvement with the program, whereas the two remaining Paiute Bands (Kaibab and Shivwits) decided to participate jointly as the Southern Paiute Consortium. A PA involving Glen Canyon National Recreation Area, Grand Canyon National Park, the Arizona SHPO, the ACHP, and the six tribes was signed on February 9, 1994.

Among other things, the PA called for the creation of a historic preservation plan (HPP) to guide future preservation activities in the river corridor (including future research and monitoring) below Glen Canyon Dam. A draft HPP was completed in 1997. This document (NPS 1997) summarized all legal mandates and authorities driving the cultural resource work in the river corridor, and it provided historical perspective on the cultural resource program accomplished up to that time. It also included an abbreviated research design to help guide future archaeological data recovery efforts in the Colorado River corridor.

Although all PA signatories had a hand in developing the draft HPP, the final draft document was rejected by

Reclamation for several reasons. A change in personnel—and a subsequent shift in Reclamation's perception of its responsibilities—was one reason for the rejection. Also, the Reclamation archaeologist felt that although the draft HPP provided ample background information about the existing program, it failed to lay out an explicit plan whereby Reclamation could fulfill its Section 106 legal obligations in a finite, timely manner (Nancy J. Coulam, personal communication 2001). Furthermore, the draft HPP did not provide a plan for assessing and prioritizing archaeological sites for future treatments. Reclamation and Western Area Power Administration (WAPA) representatives also expressed concerns about the overly general nature of the research design and questioned its suitability for guiding future research efforts or weighing the relative research values of individual historic properties.

Reclamation subsequently hired cultural resource consultant Dr. Tom King to evaluate the PA program and the draft HPP and to recommend actions that could move the Section 106 process forward. Among the recommendations included in King's (1999) review of the program were suggestions to broaden the scope of the HPP to include all cultural concerns and to explicitly delineate the responsibilities of each of the agencies and other PA signatories. Before any of King's recommendations could be implemented, however, the GCMRC cultural resource program came due for an internal review. The GCMRC management team decided that as part of this review process, a group of outside consultants should be brought in to assess the entire cultural resource monitoring and research program. This review team, subsequently known as the Cultural Protocol Evaluation Panel (PEP), made a broad range of recommendations to enhance the function and products of the cultural program. Core recommendations included: (1) to complete and adopt an HPP (the top priority); (2) to expand Native American involvement at multiple levels, including the full range of GCMRC programs; and (3) to improve the coordination and integration of the program. There were also eight supporting recommendations, four of which are directly relevant to the current research design project: (1) to prepare a systematic evaluation of historic properties, (2) to reassess geomorphological research priorities, (3) to redefine the focus of the monitoring program, and (4) to develop an integrated historic properties treatment plan. (The other four recommendations dealt with programmatic issues.) Recognizing that the research design would form a key component of the HPP and would influence other aspects of the program, the GCMRC manager, in consultation with the signatories to the PA, decided to issue a contract for the preparation of a research design and treatment framework. This document is a direct outgrowth of the Cultural PEP recommendations.

Key Issues Influencing the Structure and Content of this Research Design

There are several key issues that have stymied progress in the cultural arena of the Grand Canyon monitoring and research program. These issues are national, regional, and local in scope. On the national level, there is a growing awareness and frustration among cultural resource managers and Native American people over the limitations of the NHPA to adequately address modern Native American perspectives insofar as protection of ancestral cultural resources are concerned (Dongoske et al. 1997). This frustration stems in large measure from fundamental cultural differences in perception about the value and power of oral traditions versus historical documentation, the appropriate uses and applications of cultural knowledge, and the appropriate treatment of ancestral remains. Most important, it stems from a fundamental difference in general worldview and specific perceptions about the nature of the relationship between humans and other animate, inanimate, and spiritual aspects of the world.

Continuing on the national level, there is a recognition that "historic significance" does not adequately capture the range of values and meanings ascribed to archaeological sites by traditional peoples. Furthermore, National Register of Historic Places (NRHP) criteria for evaluation of significance are strongly biased toward the recognition and evaluation of historic structures and districts, rather than the ruined structures, rock alignments, or artifacts that typically represent the remains of ancestral Native American sites. Recently, the NRHP has attempted to resolve this problem by publishing supplementary guidelines for identifying and evaluating traditional cultural properties (TCPs) (Parker and King 1990) and archaeological site significance (Little et al. 2000), but neither of these bulletins is able to resolve fundamental differences in Native American versus Euroamerican perceptions about the cultural significance of prehistoric and historical-period archaeological sites.

On the regional level, at least eight tribal entities claim ancestral ties to the Grand Canyon: Havasupai, Hualapai, Hopi, Navajo, San Juan Southern Paiute, Kaibab Band of Paiute, Paiute Indian Tribe of Utah, and Zuni. Recently, a ninth tribe—the White Mountain Apache Tribe—has indicated an affiliation with the Grand Canyon (Jan Balsom, personal communication 2003). Each tribe holds unique ideas about what is important and significant about the Grand Canyon and its cultural resources, and they do not necessarily agree about what constitutes appropriate management of the place and its resources. In particular, the tribes are at odds over claims of ancestral affiliation to prehistoric sites and human remains, a situation exacerbated by NPS's decision to recognize all claims, regardless of whether or not they meet the statutory requirements of the Native American Graves Protection and Repatriation Act (NAGPRA). Furthermore, the Grand Canyon is part of a much broader landscape to which each of the tribes has varying historical claims and traditional obligations; hence, the significance of the Grand Canyon to each of the tribes cannot be properly comprehended apart from its broader physical and spiritual context.

At the local level, one persistent controversial issue in the Colorado River corridor cultural program has revolved around the definition and acceptance of the federal agencies' responsibilities for managing cultural sites and the land with which they are associated. Initially, much of the debate centered on defining the APE for the purposes of Section 106 compliance, but recently, this issue has been partially resolved by more-or-less arbitrarily designating all the Holocene deposits in the river corridor and all locations below the hypothetical 256,000 cubic feet per second (cfs) flow level—the hypothetical maximum flood level, with Glen Canyon Dam still functioning in place—as the APE. More pertinent to the discussion is the extent to which Reclamation dam operations are contributing to the ongoing erosion of archaeological sites in the river corridor. The resolution of this issue is necessary for assessing Reclamation's obligations to mitigate impacts from erosion that are currently affecting the integrity of many of these sites. Resolution is also pertinent from the tribes' perspectives, because it has a direct bearing on their decisions about whether or not to support excavation or other forms of mitigation at archaeological sites. Most of the tribes involved with the Glen Canyon Dam Adaptive Management Program share the opinion that impacts occurring at archaeological sites due to purely natural processes (e.g., rainfall and weathering) should not be mitigated, but that erosion caused by or exacerbated by human activities, such as the creation of trails or dam operations, is appropriate to mitigate through installing checkdams, or if no other options are available, by conducting data recovery (artifact collections and excavations). The issue of what constitutes appropriate mitigation for properties that embody both traditional cultural and scientific research values also remains unresolved.

Because these key issues have had an important bearing on the progress made and direction taken by the signatories to the PA, and because they have profoundly influenced the focus, format, and content of this research design, each is discussed in greater detail below.

Issue 1: Tribal Perspectives on Cultural Resources and Their Management

The Native American signatories to the PA come from diverse backgrounds. They speak several different languages and have diverse origins and distinct cultural traditions, and, consequently, each incorporates a unique understanding about the past, their relationships with the place called Grand Canyon, and the physical entities called "cultural resources." Therefore, it is imperative to recognize that when we speak of "tribal perspectives," the term refers to multiple and variable views held by the Havasupai, the Hualapai, the Hopi, the Navajo, the various Southern Paiute bands, and the Zuni. Despite the fact that their perspectives all diverge from Euroamerican views, there is no such thing as a single, unified perspective shared by all the tribes.

Although the tribes have different backgrounds and varying points of view, within the realm of cultural resources management, Native Americans do share some views about the world and some basic concepts about the past. These shared views reflect perceptions about the nature of the universe and the role of humankind in this universe and, therefore, differ fundamentally from most other Americans' perceptions about these matters. The tribes also share a very different understanding about how the past relates to the present and the relative value(s) of historical knowledge.

Subtopic 1: Definition of Cultural Resources

When Euroamericans use the term "cultural resource," they are usually referring to man-made or humanly modified features on the landscape, such as archaeological sites, historic structures, or artifacts. Within the past decade, the term has been expanded to include landscapes and landmarks, which may or may not have been modified by human agency, but which nevertheless are ascribed special meaning or significance by human beings. The inclusion of cultural landscapes and landmarks—also termed TCPs (traditional cultural properties) when they are tied to the perpetuation of specific traditional practices—is an important step toward incorporating Native American perspectives about cultural resources. But at the same time, however, the TCP concept—as defined in National Register Bulletin 38—does not go nearly far enough.

Traditionally, most Native American people view themselves as having a reciprocal relationship with the world in which they live. The earth gives human beings life-sustaining food, water, medicines, and the materials to make tools and shelter. Therefore, from the Native American perspective, almost everything in the physical world is a "cultural resource," as they understand the term: the plants (providers of food, medicine, textiles, and basket materials); the animals (providers of meat, hides, and feathers); the rocks (providers of pigments, clays, and building materials); and the water (provider of life).

In contrast to the Euroamerican perspective, most Native Americans view these "resources" as having their own essential "life force" (also sometimes referred to as "power"). This intrinsic power deserves acknowledgment and respect from human beings, and humans are obligated to "pay back" these resources whenever they are used. In exchange for the privilege of using the world's bounty and absorbing its power, humans have an obligation to take care of the earth and its various components by conducting the appropriate ceremonies, giving offerings, saying prayers, making pilgrimages, or carrying out other activities dictated by their respective cultural traditions.

Native Americans tend to view the man-made objects and places that Euroamericans call cultural resources—and their significance—quite differently than do Euroamericans. For example, many Euroamericans consider archaeological sites to be the abandoned locations of past human activities, with the potential to contain important scientific information about the past, whereas many Native Americans perceive of these places as the homes of their direct ancestors or of spiritual beings with the power to influence events in the present. They are also viewed as "footprints," tangible pieces of the past that have survived into the present, embodying and validating the stories and the sacred obligations of the ancestors' tenure on the land. In almost all cases, they are viewed as places that are still inhabited and in which spiritual forces reside. Furthermore, these places are a physical testament to people's past relation with the land, as well as the events that took place there. To disturb or deliberately destroy the sites through development, excavation, or by other means is perceived as a way of disconnecting people from their land and their history.

At the same time, Native Americans are highly pragmatic individuals. Many of them have one foot placed firmly in the modern world, and the other planted firmly in the world of their cultural traditions. They recognize that Euroamerican society provides certain benefits and that "progress" in the form of infrastructure development will continue to occur. Consequently, additional damage and destruction to the places that testify to their past relationship with the land is inevitable. The tribes clearly prefer that impacts to their ancestral places, and the landscape as a whole, be avoided as much as possible. In the event that impacts cannot be avoided, however, they want to make sure that their respective views about their histories and the importance of these places and the landscape are acknowledged and integrated within the framework of any future studies that involve culturally important places.

Subtopic 2: Applying the Traditional Cultural Property Concept

In 1992, the NHPA was amended to include the concept of "properties of traditional religious and cultural importance." This amendment acknowledged the reality that American society encompasses diverse ethnic groups and communities with specific traditions and values that do not always fit within typical Euroamerican constructs concerning history and historical significance. As defined in National Register Bulletin 38, a place may qualify for listing in the NRHP as a "traditional cultural property" if it is a location—a district, site (place), building, structure, or object—associated with cultural practices or beliefs of a living community that (1) are rooted in that community's history, and (2) are important in maintaining the continuing cultural identity of the community. The significance of a TCP derives from the role of the property in maintaining a community's historically rooted beliefs, customs, and practices.

Although the TCP concept was specifically intended to recognize and include places of cultural importance to modern-day Native American people (as well as other ethnic groups or communities), several problems with the way TCPs are currently defined make the concept difficult to apply from a Native American perspective. First, NRHP guidelines require that TCPs be spatially bounded. Yet oftentimes, it is the relationship of a place to its broader landscape setting—or the interconnectedness of several places across a landscape—that grants a place significance from a tribal perspective. Delimiting one specific area as separate from the landscape as a whole may therefore be conceptually impossible.

Another problem with the TCP concept arises from differing perceptions about what constitutes "valid" history and traditional practice. As noted by James Collins (1998:50–51), "history is not a given and tradition is not static." Chippindale (2000), following the work of

Akerman (1995), states this another way when he notes that the key point to understanding the meaning of the word "tradition" is "the continuity between forms old and new." Nevertheless, Euroamericans have a strong tendency to conceive of history as an objective, verifiable reality, and hence, to view Native American "traditions" as immutable practices rooted in the past, never subject to change or reinterpretation. According to Native American perspectives, however, historical narratives and cultural traditions are not frozen in the past. Rather they are teachings and practices derived from the past that serve the needs of living communities. *When* things happened is not necessarily important, but *what* happened and *where* events happened are (Basso 1996:31).

A third problem with applying the TCP concept revolves around the fact that not all places of traditional cultural importance have human modifications associated with them. In fact, some of the places that have the greatest significance to individual Native American tribes are entirely devoid of archaeological sites or other man-made features. Furthermore, in many cases, traditional beliefs and practices have led tribal members to refrain from discussing the importance of these places with outside researchers until faced with an imminent threat. This has created a misperception among some members of the general public that Native Americans are "inventing" new places of traditional cultural importance in response to threats from development or to meet current political needs.

For most Native Americans, traditional knowledge is not "data" that can be dispersed to anyone who asks for it, for it is both a valuable commodity and a source of personal and cultural power. Traditional knowledge is intellectual property that is owned by an individual, clan, or religious society (depending on the type of knowledge and the specific tribe involved). As such, it offers tangible benefits (prestige, political influence, and in some cases, financial compensation) to the individuals who have inherited or earned the right to learn it and share it with others. This knowledge is to be used to benefit family members, clan members, or the tribe as a whole. There are appropriate times and circumstances for sharing information, and generally speaking, it should only be passed on to others who are properly qualified to receive it. To lose control over this privileged knowledge by giving it away to strangers, or to give it out under inappropriate circumstances, is to invite misfortune on oneself, one's relatives, the recipient of the knowledge, and the community as a whole.

How do federal managers evaluate the significance of places in the absence of physical remains or documentation? The tribes would prefer that their viewpoints be accepted at face value, without being subject to critical scrutiny, but political realities prevent federal agencies from being able to do so. This places the tribes in the uncomfortable position of having to reveal potentially privileged or esoteric information. The requirement that the significance of a place must be documented in order to have it protected forces the tribes into a hopeless catch-22 situation. They are being asked to reveal information in a manner that is contrary to their traditional upbringing in order to protect places that are considered essential to the perpetuation of their traditions.

Subtopic 3: History as Objective Narrative versus History as Traditional Knowledge

The issue of what constitutes "valid" history from both Euroamerican and Native American perspectives is particularly pertinent to this discussion. History, after all, is a reflection of what people think about their past and how they perceive their role in the past, not necessarily the complete, unbiased reality of what took place in the past. As D. L. Birchfield, a Choctaw Indian, explains, "A people's stories about themselves, their world, and their past may leave many things unsaid, but on the whole, the things that do get said, and the way they are said, give a clearer picture of that people than any work of history can give" (Birchfield 1998:105). This observation applies equally to Euroamericans and Native Americans. For Native Americans, knowledge about the past is important because it provides the "road map" and "guideposts" for actions in the present. Whether a particular behavior is considered good or right depends to a large extent on what history—as reflected in oral traditions—has to say about it. Sometimes, events in the modern world have no clear parallel in the past. When cultural training requires a person to make sense of modern events through reference to the guidance provided by traditional knowledge, then a periodic reevaluation of this knowledge and the construction of new connections between past and present experiences may be necessary.

In his book *A Forest of Time*, Peter Nabokov (2002) summarizes the dilemma faced by non–Native American historians who try to incorporate Native American views of history as follows: "[N]on-Indian scholars must accept the fact that in research enterprises involving Indian history, Native collaboration is mandatory and usually predicated upon the ultimate benefits to the tribes. They must also appreciate that given their 'presentist' mandate, most Indian historical forms are forever 'under construction.' What is deemed traditional, historical or sacred to one generation may subtly shift categories in the next, and

Indians should not be penalized for keeping their histories pertinent" (Nabokov 2002:26). Of course, Euroamericans are not above modifying their histories to suit current circumstances either. Claude Levi-Strauss (1978) made this point when he asked rhetorically, "When we try to do scientific history, do we really do something scientific, or do we too remain astride our own mythology in what we are trying to make as pure history?"

This last question raises perhaps the most fundamental issue with incorporating Native American perspectives into Euroamerican research endeavors. The Euroamerican notion that we can study and dissect past events or the places where human activities were carried out in the past to reveal historical "truths" often has little or no relevance to Native Americans, because their perceptions about the value of historical knowledge are fundamentally different from the Western viewpoint (Basso 1996:155, footnote 7). For most traditional Native Americans, history is revealed through oral traditions and ceremonies that have been handed down through generations. Important cultural teachings are embedded in these stories and ceremonies.

The idea that historical knowledge is something to be "discovered," "researched," "tested," or "validated" is alien to most traditional Native Americans' ways of viewing knowledge about the past. As one Southern Paiute woman explained in reference to a possible connection between a specific pictograph panel and a historical ceremonial event:

> The science of archaeology may never resolve to its satisfaction the connection between the white paintings on the walls of Kanab Creek and the Ghost Dance, but for many living Paiutes an acceptable answer to the question [already] exists. A respected elder and chairman of the Kaibab Tribe said that the Ghost Dance ceremony took place below the white painted figures in Kanab Creek Canyon. At the same time, other elders of the Kaibab Paiute both had heard of the Ghost Dance and said that this was the place where it occurred. . . . For many contemporary Southern Paiute people, then, the search for a scientifically valid connection between the white paintings and the Ghost Dance is largely irrelevant. They simply know that it is so [Stoffle et al. 2000:24].

Conclusion to Issue 1 Discussion

Southern Paiutes are not alone in believing that traditional knowledge about the past does not require scientific validation. Within each tribe, there is a broad range of opinion about whether, and to what extent, the scientific study of cultural resources is an appropriate or worthwhile endeavor. Some individuals feel that archaeological research is completely inappropriate and unnecessary. Others believe that worthwhile things can be learned from doing this sort of research, even though scientific research is not a traditional way of learning about the past. Most of the tribes involved with GCMRC have acknowledged that there is some value to studying the structures, petroglyphs, and other types of cultural remains in the Grand Canyon, although there are diverse opinions about when, why, how, and where these studies ought to be conducted. Among all the tribes, however, there is general agreement that human remains should not be disturbed, if at all possible.

Learning about where their ancestors lived, the plants they used, the types of tools they made, and how ancient people made a living from the land is interesting and worthwhile to many individual Native Americans. Learning about the past environment and how it may compare to today's environment is also of interest to some. The Hopi have expressed interest in learning more details about their clan migrations and uncovering tangible evidence of ceremonies that are still practiced in the villages today.

Of paramount interest to all the tribes, however, is for western scholars to recognize that the artifacts and other physical remains left by their ancestors can be interpreted from a number of different perspectives. Above all, each tribe desires to have its own interpretation of the past acknowledged and respected, in addition to (and on equal footing with) that derived from a western scientific perspective.

The incorporation of Native American perspectives in interpreting archaeological sites is gradually becoming a standard archaeological practice, not only because it is legally mandated and is the right and ethical thing to do, but because Native American interpretations add new dimensions to standard archaeological approaches and theories, thereby providing a much fuller and potentially more accurate picture of the past.

Issue 2: Choosing the Most Appropriate Approach to Evaluating Site Significance

In 1991, following the completion of the archaeological inventory of the Colorado River corridor below Glen Canyon Dam, Grand Canyon National Park archaeologists requested an opinion from the Arizona SHPO on the NRHP eligibility of the archaeological sites located within the APE for the operation of Glen Canyon Dam. At that time, the APE was defined as the area located below the estimated 300,000 cfs flow level of the Colorado River and all areas immediately above that level consisting of Holocene-age sediment. Out of a total of 336 sites submitted for evaluation, the Arizona SHPO determined that 313 were eligible for immediate listing in the NRHP as contributing properties to an informally identified historic district. Nine others were considered potentially eligible but required testing. Seven were considered ineligible because the minimum age criterion was not met, and the remaining seven did not meet NRHP eligibility requirements on other grounds.

The NPS subsequently revisited that opinion. In 1993 and 1994, in keeping with the SHPO's recommendation, NPS archaeologists conducted testing at the nine potentially eligible sites. They concluded that all but three were ineligible, and a fourth required additional documentation (Leap 1994:7). In addition, they submitted additional documentation concerning the seven sites that were initially deemed ineligible due to age and were able to demonstrate that the sites did in fact meet the minimum 50-year guideline (Leap 1994). Ultimately, 322 sites were determined to be eligible for listing in the NRHP (Leap et al. 2000:1–5), and of these, 264 in Grand Canyon National Park were subsequently determined to be potentially susceptible to impacts from the operation of Glen Canyon Dam (Leap et al. 2000:1–8).

In recent years, the eligibility of sites within the APE has been questioned by Reclamation because the historic context(s) of the proposed historic district was (were) never clearly defined and because the proposed boundaries of the historic district were loosely based on the APE, rather than on historical or cultural criteria. However, unpublished correspondence between the NPS and Arizona SHPO indicates that the historic context was identified early on in the project as "relating to settlement, subsistence, exploration, transportation, mining, dam building and traditional cultural values during periods ranging from early Archaic times to the present" (Garrison 1993). Furthermore, the SHPO expressed concurrence with the definition of the district area as "a long, linear district along both sides of the Colorado River."

The issue of site significance has far-reaching implications for the future management of archaeological sites and other cultural resources in Grand Canyon. From a legal standpoint, federal agencies are only obligated to consider the effects of their undertakings on historic properties that are listed in or eligible for listing in the NRHP; thus, a determination of eligibility is a critical step in any endeavor that seeks to conserve cultural resources located on federal lands. Furthermore, there are important management implications in listing archaeological sites as individual properties, as multiple properties, or as part of a district. If a district is listed in the NRHP, then management agencies must evaluate the effects of their undertaking on the entire area encompassed by the district, whereas when individual sites are listed, then effects must be evaluated on a site-by-site basis. By the same token, when a group of sites is listed as a district, then it is not necessary to demonstrate that every single site within the district is significant entirely on its own merits, so long as it contributes to the significance of the district as a whole. When individual properties are listed, significance must be demonstrated independently for each one.

According to the implementing regulations of the NHPA, for a site or group of sites (district or multiple-property listing) to be considered significant, and therefore eligible for listing in the NRHP, they must meet at least one of four criteria defined by Title 36, Part 60, of the Code of Federal Regulations, which reads as follows:

> The quality of significance in American history, architecture, archeology, engineering and culture is present in districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association, and (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded or may be likely to yield information important in prehistory or history.

As noted above, for a site, district, or object to be considered significant, it must not only meet one of the four eligibility criteria, but it must also retain integrity of location, design, setting, materials, workmanship, association, and feeling. National Register Bulletin 15 clarifies that although integrity is important to determining significance, a property does not have to retain all elements of integrity to qualify for the NRHP, and furthermore, the importance of integrity elements varies according to which significance criteria are applied.

The original wording of the NHPA and the vocabulary of the original implementing regulations are strongly oriented toward the preservation of historical-period structures. This bias is apparent in the eligibility criteria, as well as in the guidance provided in National Register Bulletin 15 for evaluating the integrity of historic properties. Recently, new guidance was published on how to apply significance criteria and integrity definitions to archaeological properties (Little et al. 2000). According to the newest guidance, archaeological sites that are considered eligible under Criterion a, b, or c must exhibit more elements of integrity than those considered eligible under Criterion d alone (Little et al. 2000:35–36). For example, if a property represents a historical event or a broad pattern in history (Criterion a) or is associated with a historical figure (Criterion b), then in addition to exhibiting integrity of location, design, workmanship, and materials, it must also have integrity of setting and feeling in order to convey its significance. Setting and feeling are generally less important to conveying the significance of a site when significance is based on research potential alone, but if a site is considered significant primarily as a TCP, then these elements take on renewed importance.

According to Little et al. (2000), significance is a relative term that can only be properly evaluated within a historic context. A historic context, in turn, is defined as "a body of thematically, geographically, and temporally linked information." In the case of archaeological properties that are being evaluated primarily for their research potential, historic contexts provide "the analytical framework within which the property's importance can be understood and to which an archaeological study is likely to contribute important information" (Little et al. 2000:14). In general, a site cannot be considered eligible as a historic property "if it can not be related to a particular period or cultural group and as a result, lacks any historic context within which to evaluate the importance of the information to be gained" (Little et al. 2000:15). However, there are exceptions to this general rule. According to Little et al. (2000:15), "pre-contact sites which lack temporal diagnostics or radiocarbon dates may still be eligible within a context which defines important atemporal or non-cultural questions, such as those that concern site formation processes or archaeological methodology." This exception is particularly relevant and applicable to the evaluation of archaeological sites in the Grand Canyon river corridor. There, the effects of river processes and climate-driven changes in the riverine ecosystem have affected the physical integrity of many archaeological sites, but these sites nevertheless retain valuable information related to the formation of the physical landscape and the dynamic nature of the environment in which people lived.

A thorough understanding of geomorphological processes is of critical importance to understanding and properly interpreting Grand Canyon prehistory (Fairley 1992; Fairley and Hereford 2002). Research at sites that have been heavily reworked by riverine or other geomorphical processes can help answer important questions related to environmental processes that have been active in the canyon over time, even though these sites may lack elements of integrity that are normally deemed essential for conveying historic significance. Such sites can still provide a great deal of important information about the geomorphological processes that were operational when the site was occupied and which may have contributed to subsequent cultural events in the Grand Canyon such as population movements, changes in settlement and subsistence strategies, community aggregation, or the formation of social alliances.

The issue of what constitutes important information under Criterion d is inextricably linked to the concept of significance. Certainly size or complexity has little to do with whether a site contains important information. Most of the sites in the Grand Canyon are relatively small, and some are exclusively surface manifestations (e.g., petroglyphs). The important information these sites may provide is directly related to the research issues and questions posed in this research design. As discussed in greater detail in Chapter 6, the important information embodied by the archaeological sites in the Grand Canyon relates to the diverse and often unique ways in which people lived in, adapted to, modified, and celebrated their relationships with this remarkable landscape over thousands of years. However, it is essential to keep in mind that what is considered important today may not be considered important tomorrow, as the answers to existing questions are found and the methods for addressing new ones emerge. Furthermore, research issues of importance may surface tomorrow that have not even been conceived of today. Therefore, whereas it is impossible to foresee what questions may arise in the future, we should not be too hasty to discount sites and label them as insignificant just because we cannot predict what useful information they may offer for future researchers. One only has to look a short distance upriver, to the area now inundated by Lake Powell, to be reminded in hindsight of how much could have been learned from sites that at the time were deemed uninformative and therefore "insignificant" (Geib 1996:2–3).

Another issue concerning the evaluation of site significance in the Grand Canyon river corridor revolves around the concept of redundancy. Redundancy implies that a property is a duplicate of many other similar or identical entities, and, therefore, important information is not likely to be gained from studying or preserving a redundant site. Aside from inherent problems that arise from the concept of redundancy (i.e., that sites that look similar will contain identical kinds of information), one must ask if it is really possible to have truly redundant sites in an environment as unique and environmentally diverse as the Grand Canyon. After all, nowhere else in North America do we find a snowmelt-fed river flowing through an arid environment in the heart of a massive sedimentary plateau rising more than a mile above the river bottom. In this unique landscape—where three of the four North American desert ecosystems converge, and a layer cake of Paleozoic rocks and minerals are exposed, hosting a diverse, elevationally zoned, and geographically compact assortment of flora and fauna—humans were confronted with unique challenges and unprecedented opportunities. If the concept of redundancy has any application to sites in the Grand Canyon, it is only in comparison to other sites within the river corridor. Nowhere on the Colorado Plateau did people have as many options, or contend with as many variables, as in this ecologically diverse, topographically challenging, and dynamic environment.

Up to this point, cultural resource significance has been discussed mainly in terms of Criterion d. For the Native American signatories to the PA, however, it is not the information potential that makes prehistoric sites significant; rather, it is their association with past events, traditional teachings, or historical-mythical beings that makes these places important and worthy of protection (Anyon et al. 1997; Ferguson et al. 1993). Moreover, archaeological sites are only one of several kinds of TCPs in the Grand Canyon that the tribes consider significant. There are also rock outcrops, mineral sources, trails, springs, and the river itself, almost none of which was documented as part of the archaeological inventory. In addition, many landscape features that do not qualify for listing in the NRHP hold cultural importance to the tribes. These include the many native plants and animals living within the river corridor that were (and sometimes still are) used traditionally by Native American inhabitants of the region.

Given all the limitations and conceptual parameters outlined above, a landscape (district) approach to determining archaeological site significance in the river corridor makes the most sense—economically, politically, ethically, and theoretically. First, the landscape approach emphasizes myriad linkages between the many individual residential sites, trails, landmarks, the river, and the environment as a whole. These linkages confer (or add) meaning and significance to the various individual cultural properties. Also, a landscape approach incorporates areas, such as prehistoric fields or specific resource-gathering areas, that were not identified as sites during the survey because they did not fit the definition of having "one or more human-made features or a cluster of artifacts" (Fairley et al. 1994:8). Although not recorded as sites, many such places exist within the river corridor that could contribute information important to understanding human history in Grand Canyon. A landscape approach to evaluating cultural-resource significance is also more compatible with traditional Native American views about what makes places culturally important and worthy of preservation. A Native American rationale for using a landscape approach is explored in greater detail in Chapter 4, and a theoretical basis for using this approach is outlined in Chapter 6.

Another reason why a site-by-site approach is inappropriate in the river corridor is the extensive amount of burial and erosion by water and wind. Demonstrating significance for each and every archaeological site in the Grand Canyon river corridor would require an extensive program of subsurface testing, since surface manifestations do not normally reflect the depth, complexity, or integrity of subsurface remains in this dynamic environment. In addition, although the survey field crew was instructed to pay close attention to cut banks and arroyo walls, many sites were undoubtably missed during the survey because they were obscured by overburden or by dense vegetation growth. For example, most of the Pueblo I and preceramic sites that have been documented within the river corridor came to light as a result of geoarchaeological studies, rather than through the surface inventory process. The site-specific approach, whether applied individually or as part of a multiple-property nomination, ignores the geomorphological complexity of the riverine setting.

There are also methodological reasons for choosing a landscape-level approach, rather than a site-specific approach. One reason is that the definition of "site" employed during the survey is an artificial construct that does not adequately or accurately reflect the extent or complexity of human use along the river. During the 1990–1991 inventory, sites were defined as "one or more human-made features or a cluster of artifacts representing a former locus of human activity" (Fairley et al. 1994:8). The definition did not specify any minimum number of artifacts or areal extent, in recognition of the fact that many human activities do not result in the deposition of extensive remains. Also, sites in the river corridor are often obscured by overburden, and only a small portion appears at the surface. However, the original definition lacked explicit instructions for bounding sites on the landscape. This decision was left to the judgment of each crew chief in the field, based on whether or not a continuous artifact distribution or obvious spatial linkage could be established between artifact and feature loci. In general, when there were extensive intervening areas with very few or no artifacts, crew chiefs were encouraged to split loci, rather than lump them, in order to allow for more-detailed recording of each locus and to avoid making assumptions about the interconnectedness of spatially discrete areas. For example, in the western Grand Canyon, a typical protohistoric site consists of a series of roasters situated on an alluvial fan near a rockshelter containing artifacts indicative of domestic use. In many cases, there is a more or less continuous distribution of artifacts between the rockshelter and the roasters, and in these cases, all of the features were included as one site. In other situations, however, the rockshelter was situated at some distance from, and often well above, the level of the roasters, which were separated by dunes or a talus slope without a continuous scatter of artifacts in between. In these situations, the two loci were usually recorded separately, even though the two areas probably constituted a single locus of past human activity.

There are many other similar examples of instances when rather arbitrary judgments were made about what to include within the boundaries of a single site. Thus, the definition of sites is highly variable and ultimately may have little to do with the realities of what took place at and between those locations in the past. A landscape approach negates the importance of defining discrete sites, focusing instead on the range of uses, activities, and cultural perceptions encompassed by the Colorado River corridor over a broad time span.

Finally, the landscape approach fits with the overarching goals of the Grand Canyon Protection Act and the GCMRC program. The Grand Canyon Protection Act mandates that Glen Canyon Dam be operated "in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established, including but not limited to natural and cultural resources and visitor use." The act does not specify that only those cultural resources meeting the eligibility requirements of NHPA deserve protection. Furthermore, the mission of the GCMRC is "to provide credible, objective scientific information to the Glen Canyon Dam Adaptive Management Program on the effects of operating Glen Canyon Dam on the downstream resources of the Colorado River ecosystem, utilizing an ecosystem science approach." Although not specifically defined, an ecosystem science approach presumably includes studying the functional interrelationships between the river and adjacent physical, biological, *and cultural* resources (Sullivan et al. 1999). A landscape approach not only recognizes, but emphasizes, the interplay between "natural" and "cultural" components of the river-corridor ecosystem and the Grand Canyon physiographic province as a whole.

Issue 3: Evaluating Causes of Site Erosion and the Effects of Dam Operations

The causes and consequences of archaeological site erosion in the Grand Canyon have been a topic of considerable controversy and debate for the past 10 years. The erosion of sandbanks and sandbars (euphemistically termed "beaches") along the Colorado River in the Grand Canyon has been an important resource-management issue for NPS since the mid-1970s (Dolan et al. 1974; Howard and Dolan 1976), and beach erosion was one of the key environmental impact issues that led to the passage of the Grand Canyon Protection Act in 1992. Although the need to understand and quantify the processes contributing to sediment loss in the river-corridor ecosystem currently drives many aspects of the research and monitoring program within the GCMRC, a firm consensus about the relationship between dam operations, sediment depletion, and the ongoing erosion of archaeological sites in the river corridor still eludes scientists and agency personnel.

Resolving the site-erosion issue is important for a number of reasons. First, there is no doubt that sites along the river are actively eroding, and that the continuing loss of the site matrix will ultimately lead to the loss of site integrity and associated research values. Second, if the causes of ongoing site erosion were determined to be largely unrelated to the dam or its operations, then Reclamation would have little or no responsibility for mitigating the effects of the erosion, and all responsibility for maintaining the condition of the resources would rest with the NPS, which has a continuing responsibility for maintaining the historic fabric of these sites under Section 110 of NHPA and also under the 1916 Organic Act. On the other hand, if the erosion is due in part to dam operations, then Reclamation retains some responsibility for mitigating the effects of this undertaking on the resources. Finally, most of the tribes want to know whether the erosion is caused by human activities or by natural processes, because from their perspective, the answer determines whether or not intervention (mitigation) is appropriate.

Complicating the resolution of this issue is the fact that the effects on the ecological system that result from the dam's existence are considered, in a legal sense, to be separate from the effects of dam operations. Legally speaking, Reclamation disavows responsibility for the effects of the dam's presence because the dam was built before the National Environmental Policy Act and NHPA were passed, and neither of these laws apply retroactively. Yet it is clearly the dam itself that has had the biggest impact on the downstream river ecosystem (Andrews 1991:73). As a result of Glen Canyon Dam, and the sediment-filtering effect of the resulting reservoir, the amount of sediment moving through the Grand Canyon portion of the Colorado River system has been reduced by more than 90 percent (Andrews 1991; Laursen et al. 1976). Dam operations have exacerbated sediment loss downstream, but it is exceedingly difficult to tease apart the "operational" effects on the sediment budget from the effects of the dam itself (Rubin et al. 2002).

Furthermore, the interrelated nature and variety of geomorphological processes that may be contributing to the erosion of archaeological sites in the river corridor are difficult to study anywhere in the Southwest, and especially at the bottom of the Grand Canyon. Indeed, geomorphologists have been grappling with the causes of arroyo formation in the American Southwest for more than half a century without reaching consensus on the issue (Bryan 1925, 1928; Cooke and Reeves 1976; Huntington 1914; Leopold 1951; Webb 1985). Climate, vegetative cover, soil type, catchment size and shape, rainfall frequency, and flood intensity have all been implicated, but no single factor is clearly the primary cause in all cases. Given the lack of consensus on this issue, it is doubtful that a single cause, or even the primary cause, of arroyo formation in the Grand Canyon will be unequivocally established in the near future. Because of this, King (1999) and the GCMRC Cultural PEP team both recommended that no additional funds be expended in this arena. Instead, they advised that Reclamation and the NPS negotiate an agreement to accept joint responsibility for the continuing loss of resources (Doelle 2000:17). This would allow the agencies to move forward with other compliance tasks, take appropriate action to mitigate ongoing impacts, and fulfill their respective Section 106 and Section 110 responsibilities. To date, this recommendation has not been implemented, and the path to the resolution of this contentious issue remains unclear.

Issue 4: Prioritizing Research Values in Relation to Traditional Cultural Property Values

As noted in the introduction to this chapter, the RFP for this research-design project specified that one goal was to "provide a framework for the treatment of all cultural resources." Developing a single framework that can accommodate the diverse and, in some respects, contradictory values of archaeologists and Native Americans is a daunting task. Archaeologists generally value archaeological sites as repositories of potentially important (or at least interesting) information about the past. Although most recognize and acknowledge ancestral connections between modern Native American tribes and the prehistoric archaeological record, they nevertheless value the sites primarily for their informational potential.

Native Americans value archaeological sites for their spiritual and symbolic value, as well as for their historical connections. Informational potential is not an important value relative to these other concerns, although some Native Americans are very interested in what archaeology has to say about their pasts (Ferguson et al. 1993:32). In terms of NRHP criteria of significance, however, Native Americans will argue that Criterion a (events important in history) and Criterion b (individuals important in history) are more important—or at least as important—as Criterion d in determining site significance.

The landscape approach offers a unified framework for bringing these divergent perspectives together. Landscape anthropology explicitly acknowledges the symbolic and cognitive processes involved in the formation of cultural landscapes. The landscape approach also recognizes that cultural-landscape formation is a continually ongoing process; therefore, there is no meaningful break between the time periods that archaeologists frequently dichotomize as prehistory and history. Furthermore, this approach recognizes that the meanings applied to landscapes are not static and immutable but change over time as cultures evolve and as their physical connections to places are altered. What was once "home" can later become a "spiritual homeland." A place once perceived mainly in terms of its mineral potential can evolve into an icon for wilderness worldwide. How this happens, and the interpretation of the physical traces left by the process, is the focus of this research design.

Organization of this Research Design

The remainder of this document is organized into six chapters. Chapter 2 summarizes current environmental conditions and provides a synopsis of what we think we know about past environmental settings in the river corridor. Chapter 3 summarizes previous ethnographic, historical, biological, and archaeological research undertaken in the Grand Canyon region, with a particular emphasis on past archaeological research within the river corridor. Chapter 4 explores Native American perspectives concerning the significance and cultural importance of the Grand Canyon and the Colorado River to the affiliated tribes. Chapter 5 brings together diverse archaeological opinions about the Grand Canyon's human story, with the aim of highlighting key points of agreement and dispute, as well as significant knowledge gaps. Chapter 6 presents the theoretical basis for using a landscape approach to organize future research efforts in the Grand Canyon, along with a list of topics and specific questions that could be addressed within a landscape framework. Chapter 7 attempts to reconcile the landscape approach with NHPA compliance requirements and offers several points for the consideration of interested tribes and agencies when determining future treatment options within the Grand Canyon river corridor.

CHAPTER 2

The Environmental Setting Through Time

The Grand Canyon is a unique place. Nowhere else in the world do the three principal physical factors responsible for the existence of the world's most famous canyon come together in one location: (1) a snowmelt-fed river originating on a continental divide and draining an area approximately one-twelfth of the continental United States; (2) a massive, uplifting plateau composed of thousands of feet of competent, horizontally bedded, and largely undeformed sedimentary strata; and (3) an arid to semiarid environment. The intersection of these three variables has created a physical landscape encompassing extreme diversity in terms of climate, vegetation, geology, and topography. The cultural systems that evolved in this unprecedented environmental setting are likewise unique and diverse.

Physical Setting

The Colorado River is the key attribute and principal geomorphic agent of this unique landscape known as the Grand Canyon. As the principal fluvial system, it drains an area approximately 244,000 square miles in extent, including 90 percent of the Colorado Plateau physiographic province and portions of the adjoining Rocky Mountain and Basin and Range Provinces. Flowing southwestward from headwaters in the Rocky Mountains to the Sea of Cortez, it descends approximately 13,400 feet and travels approximately 1,450 miles through diverse geologic strata and varied ecological settings. Along this course, 35 perennial streams and numerous minor tributaries contribute to the flow. The major perennial tributaries, in descending downstream order, are the Green, Dirty Devil, Escalante, San Juan, Paria, Little Colorado, and Virgin Rivers (Figure 3).

Upstream of the Grand Canyon, before construction of Glen Canyon Dam, the river flowed through a spectacular canyon bounded by colorful sandstones and shales of Mesozoic age. South and west of the Echo Cliffs Monocline, at the western end of Glen Canyon, the Mesozoic strata are stripped from the surface of the plateau, exposing a broad platform underlain by the youngest Paleozoic unit of the southern Colorado Plateau, the erosion-resistant Kaibab Formation. This Permian-age sandy limestone forms the rim of the Grand Canyon as far west as the Toroweap Fault. Below this distinctive caprock layer are a series of progressively older Paleozoic sandstones and limestones approximately 3,000 feet thick, which in turn overlie much older Precambrian-age rocks. The Precambrian rocks include wedges of slightly metamorphosed sandstones and shales intruded by diabase sills (the Grand Canyon "Super Group" rocks), bounded by large Paleozoic faults. The Super Group rocks abut extensive areas of metamorphic Vishnu Schist interspersed with plutonic intrusions of igneous Zoraster Granite. West of the Toroweap fault, where the uppermost Paleozoic layers have been stripped away, Quaternary basaltic lava flows overlie the Supai Formation, which forms a broad inner-canyon benchland (Figure 4).

Although relatively free of structural deformities when compared to many other parts of the world, the Colorado Plateau exhibits a variety of geological structures that strongly influence the form and dimensions of the Grand Canyon. Just below the mouth of the Paria, bedrock strata slope sharply upward toward the south and west. Bounded by the Echo Cliffs Monocline on the east and the East Kaibab Monocline on the west, the river has

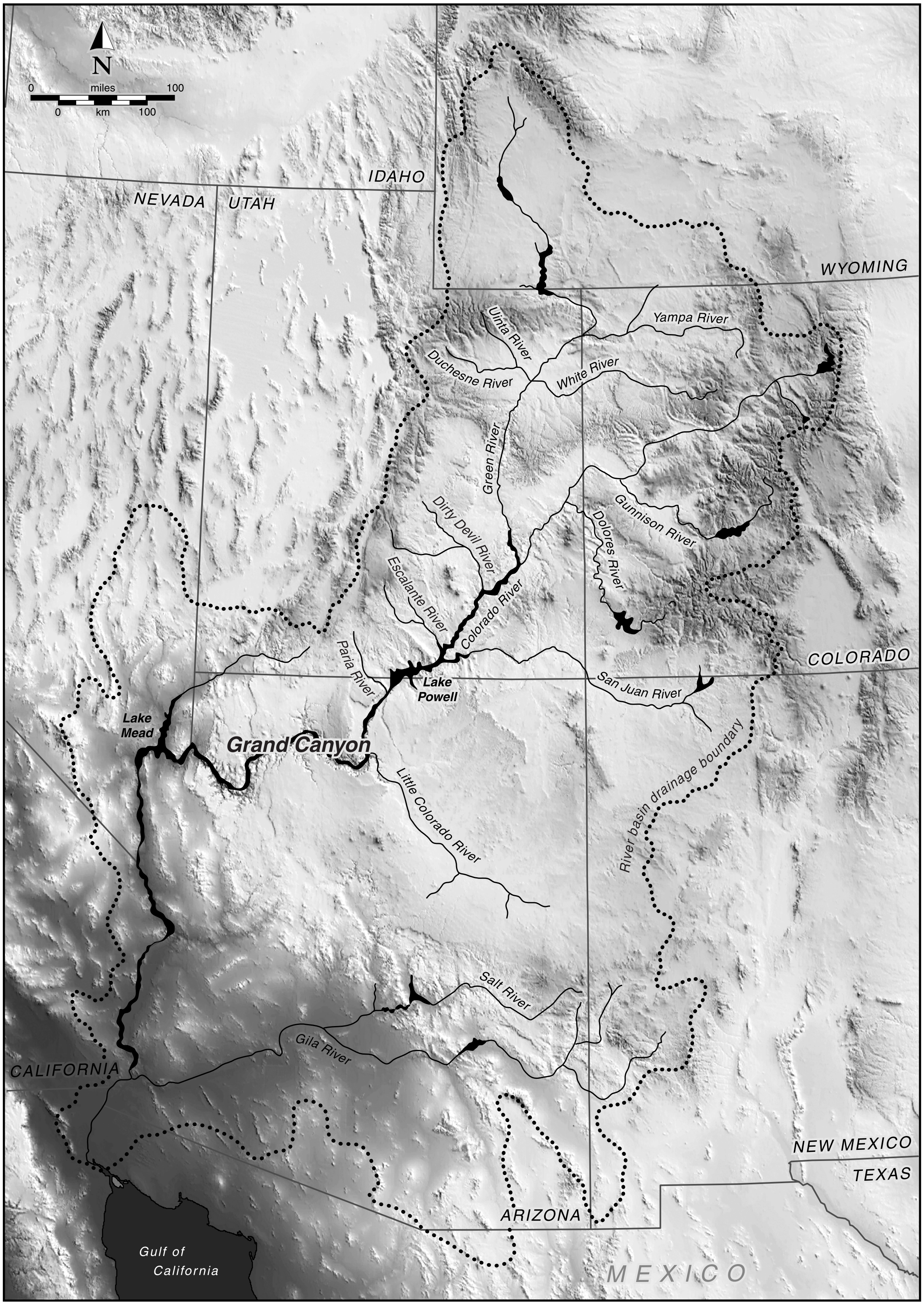

Figure 3. Map of the Colorado River drainage basin.

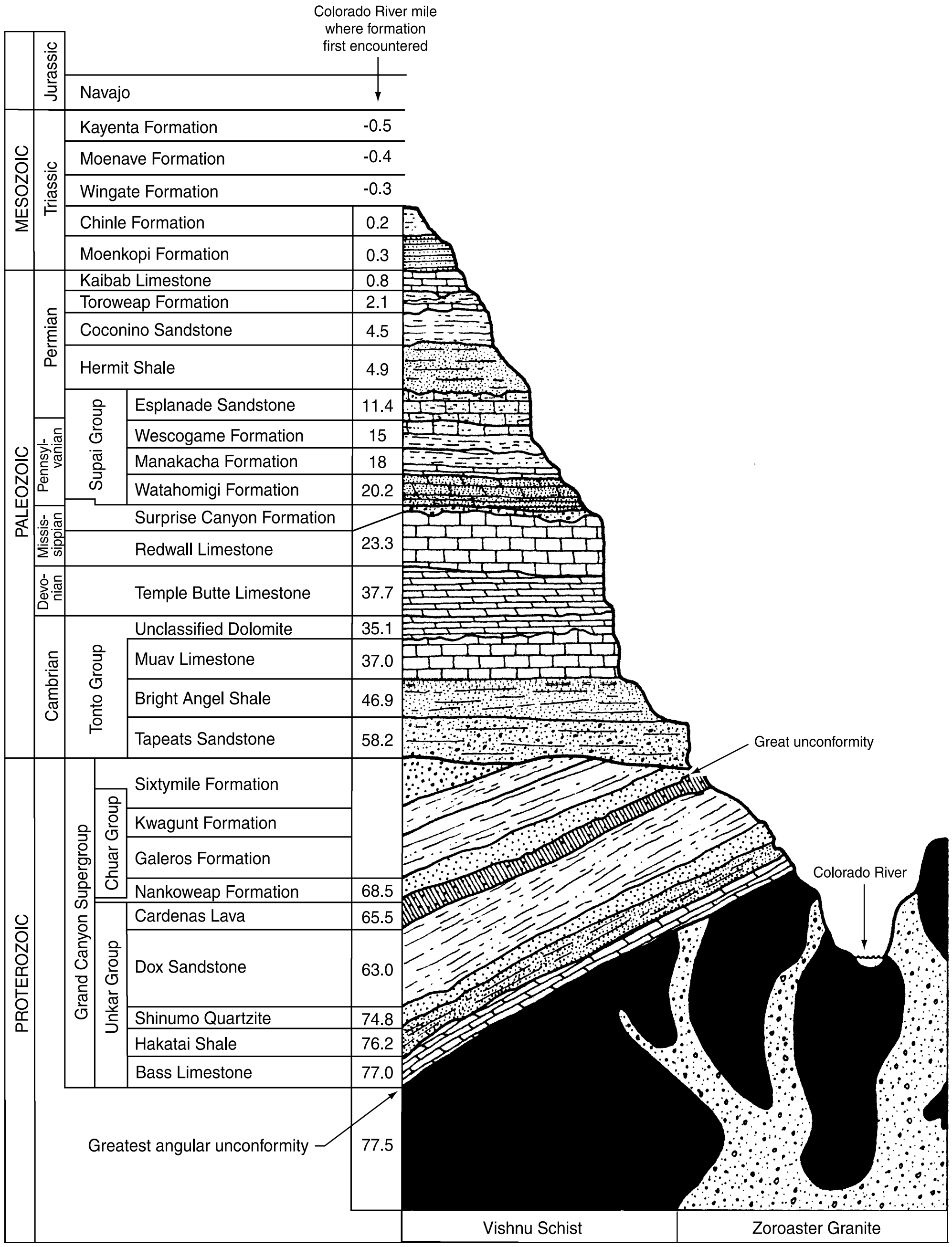

Figure 4. Principle geologic strata in lower Glen Canyon and Grand Canyon. (Figure from *The Grand Canyon, a Century of Change: Rephotography of the 1889-1890 Stanton Expedition*, by Robert H. Webb. © 1996 The Arizona Board of Regents. Reprinted by permission of the University of Arizona Press.)

cut a narrow, relatively straight-walled, predominantly north-south-oriented chasm known as Marble Canyon. Below Marble Canyon and the confluence of the Little Colorado River, the river swings westward and traverses the Kaibab Upwarp, exposing multiple layers of Paleozoic and Precambrian rock more than a mile deep. The river crosses the Kaibab Upwarp south of its highest point, and, as a result, the North Rim of the canyon is approximately a thousand feet higher than the South Rim. In addition, the canyon crosscuts a series of large, north-south-oriented normal faults. These faults create a stair-step-like topography of eastward-dipping plateaus bounded by sheer fault scarps along their western margins. From east to west, the plateaus on the north side of the Grand Canyon are known as the Kaibab, Kanab, Uinkaret, and Shivwits (Figure 5). A final fault scarp known as the Grand Wash Cliffs bounds the western edge of the Colorado Plateau and demarcates the

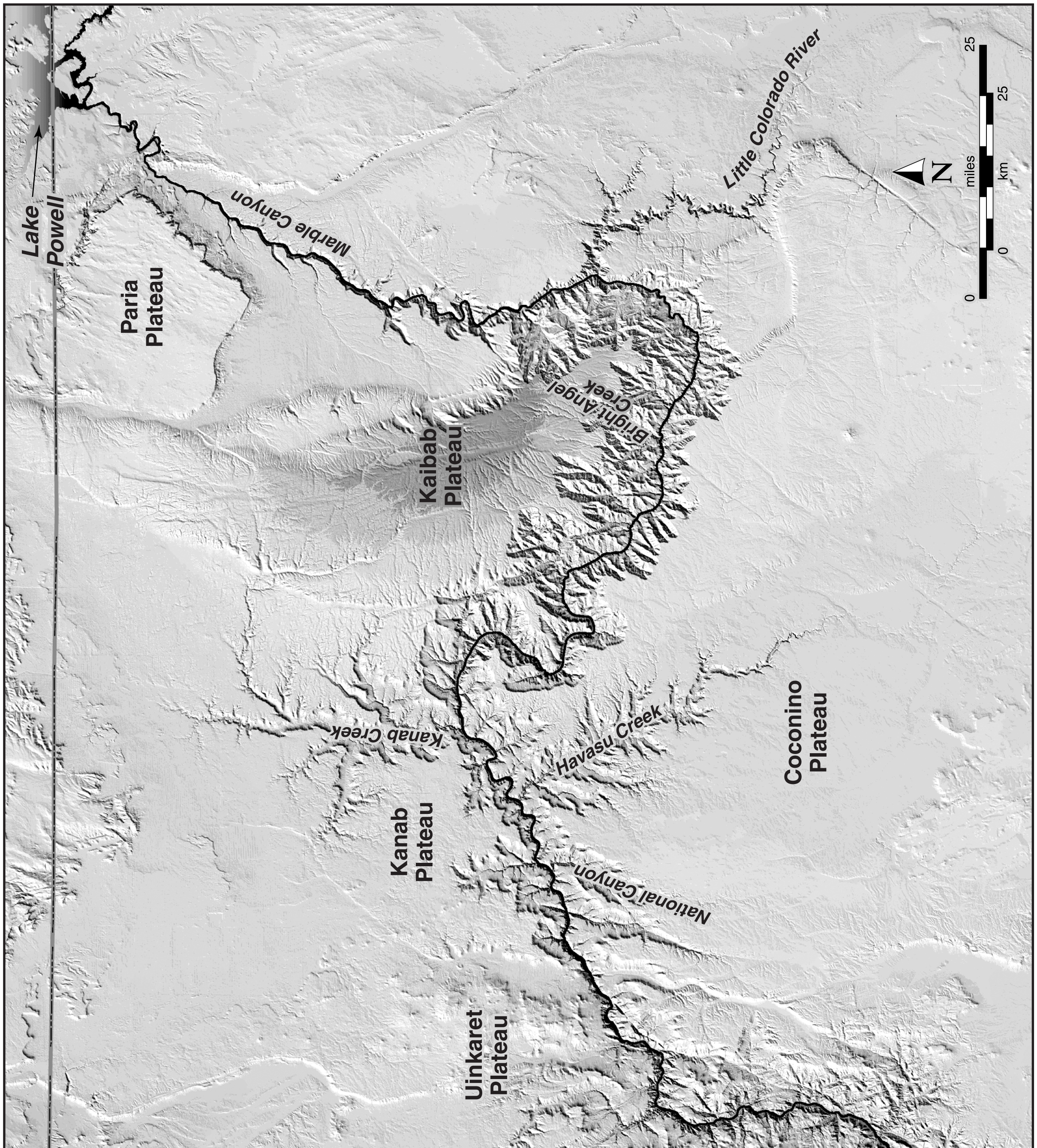

Figure 5. Major topographic features, drainages, and reservoirs in the Grand Canyon region.

western end of the Grand Canyon. West of this scarp, the river breaks free of its confining chasm into the open, low-lying Basin and Range Province beyond.

The numerous north-south-trending faults that crosscut the canyon control the locations and configurations of tributary drainages. The structural northward dip of strata causes the tributaries north of the river to be much longer than those to the south, with more-permanent and higher-volume discharges of water. Tributary gradients exceeding 800 feet per mile are common on the south side of the river.

The numerous faults and associated drainages provide natural travel corridors between the river and rim for both wildlife and humans. Humans used these routes to access the canyon's various resources. The geological layers exposed in and around the Grand Canyon offered a wide array of useful materials for prehistoric and later peoples, including building materials; minerals such as copper, asbestos, salt, and hematite; pottery clays and temper; in addition to raw materials suitable for grinding implements, flaked stone tools, and ornaments.

Geomorphic Characteristics of the River Corridor

The character of the river changes as it crosses various rock layers and structural features, with massive, more-resistant rock types typically forming narrow canyons, and the less-erosion-resistant layers creating more open, meandering settings. Geologists (Melis 1997; Schmidt and Graf 1988) have partitioned the river corridor below Glen Canyon Dam into "reaches," based on changes in bedrock morphology at river level and the resulting differences in the geomorphic character of the canyon (Figure 6). Although the work of Melis (1997) offers a sound hydrogeologic rationale for using a 4-reach system to characterize the river corridor, the reach system proposed by Schmidt and Graf (1988:8) has been used previously to characterize different segments of the river corridor from the perspective of past human use (e.g., Fairley et al. 1994). The latter approach is therefore continued in this research design (Table 1).

The first segment, Reach 0, includes the only remaining portion of Glen Canyon not inundated by Lake Powell. Extending from the base of Glen Canyon Dam to Lees Ferry, this 15.5-mile-long section is geologically distinct from other reaches, owing to the fact that the river flows through a spectacular canyon bounded by sheer cliffs of Jurassic Navajo Sandstone. Talus slopes and a few broad sand and gravel terraces line the riverbanks within this stretch, but in several places, the sheer sandstone walls descend directly to the river, preventing continuous pedestrian travel along the shoreline. Several steep routes descend from the rims to the river in this reach; consequently, evidence of human occupation is quite abundant, as this reach contains the second highest density of archaeological sites recorded in the river corridor (Fairley et al. 1994:17). The river cuts across the Echo Cliffs Monocline near the southern end of this reach, bisecting the Kayenta, Moenave, and Wingate Formations before breaking out into fairly open terrain upstream of Lees Ferry (Figure 7).

Reach 1 extends from Mile 0 (the USGS gauging station at Lees Ferry) to Mile 11.3 near Salt Water Wash. In the first mile of this reach, undercutting of the relatively soft Chinle Formation at river level has caused the surrounding cliffs to retreat, creating a relatively open bottomland along both sides of the river. Below Mile 1, the river begins to incise the erosion-resistant Kaibab Formation. The canyon walls rise steeply as the river descends through northward-dipping Toroweap Formation, Coconino Sandstone, and Hermit Shale.

In Reach 2, between Miles 11.3 and 22.6, the river is confined to a narrow gorge between red-stained walls of Pennsylvanian-age Supai Formation. Continuous pedestrian travel at river level is impossible in the upper portion of this reach, because bedrock ledges are discontinuous, and there are extensive stretches lacking talus slopes. Below the confluence with Rider Canyon near Mile 17, there is sufficient talus along the riverbanks to allow passage by foot, although pedestrian travel is nevertheless arduous.

At the beginning of Reach 3, Mississippian-age Redwall Limestone emerges at river level. Between Miles 22.6 to 35.9, sheer Redwall cliffs enclose the river in an ever-deepening gorge. Numerous debris fans at the mouths of steep drainages create a succession of rapids in the first five miles, but beyond Mile 28, the rapids decrease and the river flows at a more leisurely pace between towering gray limestone walls. The Fence fault crosses this reach near Mile 30, creating broken topography and a natural travel route from the east rim of the canyon to the river, whereas on the west side of the river, the South Canyon drainage offers a route out of the canyon to the west (Figure 8).

Reach 4 extends from Mile 35.9 to the mouth of the Little Colorado River at Mile 61.5. In this section, the river crosses a transgressive sequence of Cambrian-age sedimentary strata. The Muav Limestone, Bright Angel Shale, and Tapeats Sandstone have different levels of resistance to erosion, and hence this segment of the canyon has more variable geomorphology than the preceding segments. The canyon remains sheer and relatively narrow as far as Mile 40, then gradually becomes more open downstream. Large debris fans and associated sandbars are found at the mouths of Nankoweap and

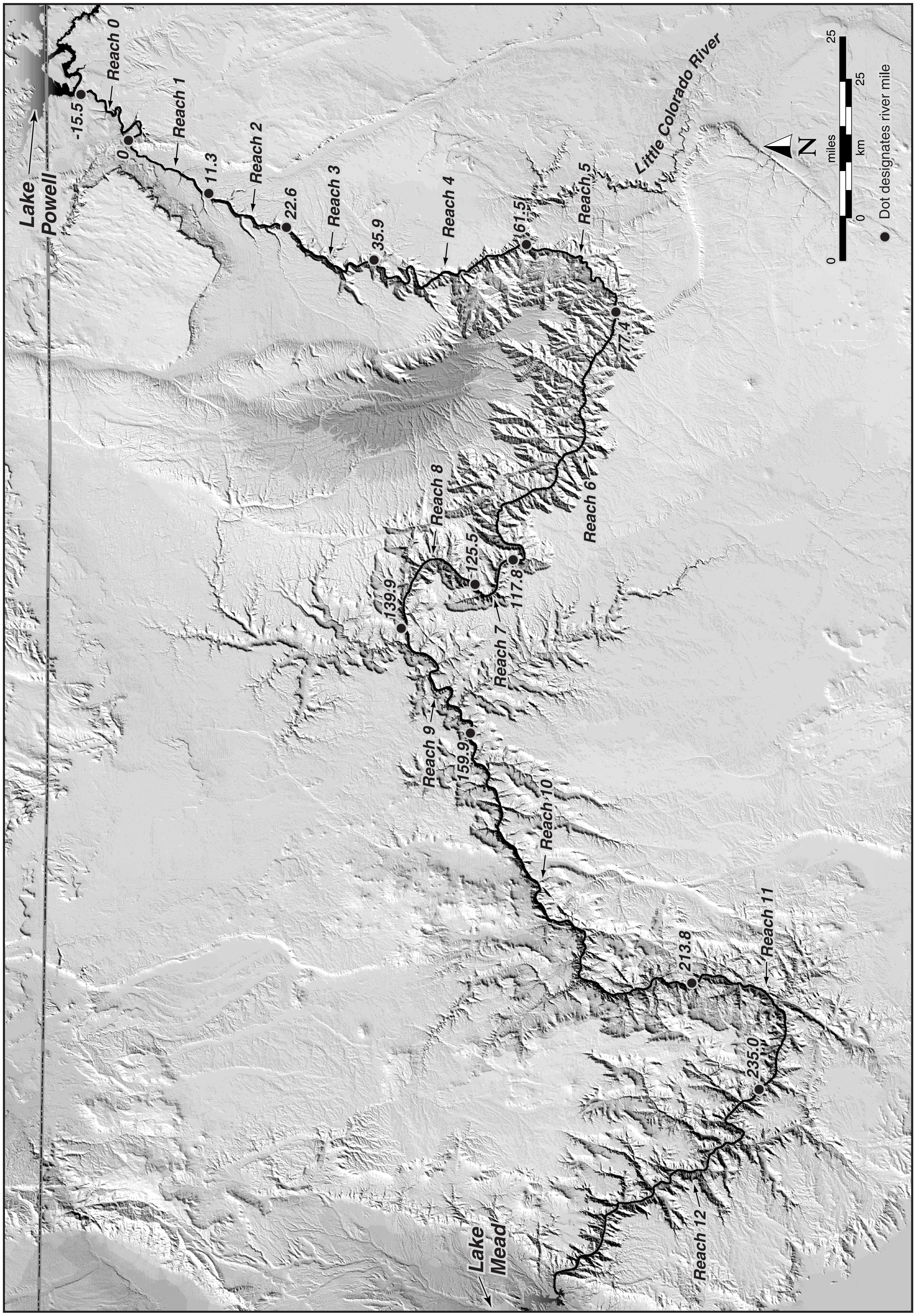

Figure 6. Designated reaches along the Colorado River below Grand Canyon Dam.

Table 1. River Corridor Reaches by River Mile

Reach Number	Reach Name	River Miles
0	Glen Canyon	5.5–0.0
1	Permian Section	0.0–11.3
2	Supai Gorge	11.3–22.6
3	Redwall Gorge	22.6–35.9
4	Lower Marble Canyon	35.9–61.5
5	Furnace Flats	61.5–77.4
6	Upper Granite Gorge	77.4–117.8
7	Aisles	117.8–125.5
8	Middle Granite Gorge	125.5–139.9
9	Muav Gorge	139.9–159.9
10	Lower Canyon	159.9–213.8
11	Lower Granite Gorge	213.8–235.0
12	Lake Mead	235.0–278.0

Kwagunt Canyons, and smaller alluviated debris fans occur at the mouths of most other North Rim drainages, with intervening stretches characterized by steep but continuous sand-covered talus slopes at river level. The presence of the debris fans, sandbars, and talus slopes, in conjunction with the increasingly open character of the canyon and the presence of cross-canyon travel routes near Miles 43 and 50, create an environment more conducive to human travel and occupation than that of the three preceding reaches (Figure 9).

The next 16 miles, between the Little Colorado River confluence to the mouth of Red Canyon at Mile 77.4, constitute Reach 5. In the first four miles of this reach, the canyon walls are relatively confined by ledges and cliffs of Tapeats Sandstone. At Mile 65, where Palisades and Lava-Chuar Creeks discharge into the river from opposite sides, the river crosses a huge Precambrian fault, and the canyon topography changes abruptly. From this point down to about Mile 73, the river flows through open terrain characterized by broad, sandy shoreline terraces bounded by the rounded hills and comparatively gentle slopes of Precambrian Dox Formation. Unkar Creek joins the river near Mile 72. A broad debris fan, known colloquially as Unkar Delta, is located at the confluence (Figure 10). Below this point, the canyon walls close in again. Reach 5 contains the highest average density of archaeological sites of any reach in the river corridor, with the majority of sites concentrated between Miles 65 and 72 (Fairley et al. 1994:16).

Red Canyon and Hance Rapids mark the beginning of Reach 6 (Figure 11). Also known as the Upper Granite Gorge, this is the steepest and second narrowest reach in the 240-mile stretch below Glen Canyon Dam. The river corridor is characterized by dramatic walls of dark-colored Precambrian schist interspersed with veins of quartz and granite. Short stretches of swift but relatively tranquil water are separated by numerous large rapids: Sockdolager, Grapevine, Horn Creek, Granite, Hermit, Crystal, "The Gems," and Waltenberg. Some of the numerous perennial sidestreams found throughout this reach include Clear Creek, Cottonwood, Bright Angel, Pipe Creek, Monument, Crystal, Shinumo, and Elves Chasm. There are very few sandbars in this section. Although this reach contains travel routes down to the river, continuous foot travel along most of the banks is next to impossible because of vertical walls and discontinuous talus slopes.

The beginning of Reach 7 is marked by a structural feature, the Monument Fold, which brings the Tapeats Sandstone back to river level at Mile 117.8. Tapeats Sandstone cliffs confine the river for the next three miles. The corridor then widens out for several miles below 122 Mile Canyon, and large aeolian dunes are present on the left bank down to the mouth of Fossil Canyon. Continuous foot travel is possible along both sides of the river on the sloping bench above the Tapeats Sandstone layer.

Reach 8, between Miles 125.5 and 139.9, corresponds to Middle Granite Gorge. There are two significant breaks in the generally constricted topography of this reach: Miles 130.5–135 and Miles 136–137.5. In the first break, Precambrian Super Group rocks emerge at river level again, and dark-colored diabase cliffs form the

Figure 7. Overview of the Lees Ferry area: top, looking upstream (Reach 0); bottom, looking downstream (beginning of Reach 1) (photographs by Richard Hereford).

Figure 8. Downstream view of Reach 3 near South Canyon. Archaeological site AZ C:5:1 in foreground with Vasey's Paradise in background.

lowest canyon walls. The second topographic break is created by a massive landslide deposit. Throughout most of the rest of this reach, the canyon walls are composed of Precambrian schist and granite. Several significant North Rim tributaries merge into the river along this stretch, including Stone Creek, Tapeats Creek, and Deer Creek (Figure 12).

Below the mouth of Fishtail Canyon, the Muav Formation reemerges at river level. A narrow, vertical-walled chasm characterizes the river corridor for the next

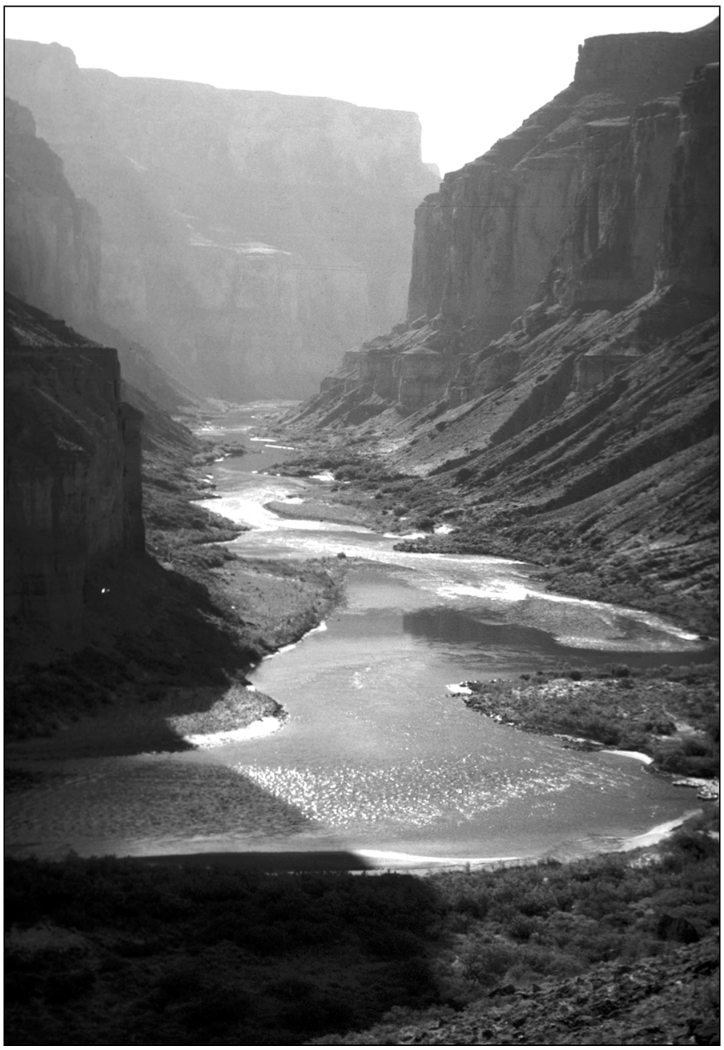

Figure 9. Downstream view of Reach 4: top, from the Eminence Break trail; bottom, from Nankoweap granaries.

20 miles. Kanab Creek enters the river at Mile 145. A modest debris fan is found at the mouth of Kanab Creek, but in general, debris fans are few and relatively small in Reach 9. Very few sandbars occur along this reach.

Reach 10 begins a few miles above the mouth of Tuckup Canyon, at Mile 159.9, and extends approximately 54 miles downstream to Mile 213.8. Between Miles 159.9 and 178, the canyon remains relatively narrow, but below the mouth of Prospect Canyon and Lava Falls, the river corridor becomes progressively wider. The lower portion of this reach (below Lava Falls) is crossed by numerous faults, resulting in a more open, eroded landscape with numerous possibilities for cross-canyon travel. Some of the known access routes from the rims to the river in this reach include Tuckup, National, Mohawk, Stairway, Redslide, the Toroweap-Prospect Canyon route, the Bundy Trail–Whitmore Wash routes, 196 Mile Canyon, Parashant Canyon, 205 Mile, 209 Mile, and Granite Park Wash. There are undoubtedly many others as well. Alluviated debris fans occur at the mouths of tributary canyons throughout the entire reach, and many of them show signs of past human occupation. The 1990–1991 archaeological inventory of the river corridor recorded the third highest average density of archaeological sites per river mile in this reach (Fairley et al. 1994:16) (Figure 13).

Reach 11, located between Miles 213.8 and 235, corresponds to a stretch of river known as Lower Granite Gorge. Schist and granite outcrop at river level briefly at Mile 212 and then more continuously below Mile 214. Throughout the upper half of this reach, Tapeats Sandstone forms a prominent bench that is readily accessible from the river, and the Tapeats bench provides a relatively accomodating pedestrian travel corridor throughout this reach. Small to medium-sized alluvial fans are located at the mouths of many of the side canyons. As in Reach 10, these fans were favored locations for human habitation, as they continue to be for river runners today.

Prior to construction of Hoover Dam, the river coursed through schist and lava flow remnants for an additional 30 miles. The last few miles of the canyon were bounded primarily by Tapeats Sandstone as far as the Grand Wash Cliffs. Today, this portion of the Lower Granite Gorge is inundated by slack water from the impoundment of the Colorado River, and lake waters lap against the Tapeats Sandstone and higher Paleozoic strata throughout most of this reach.

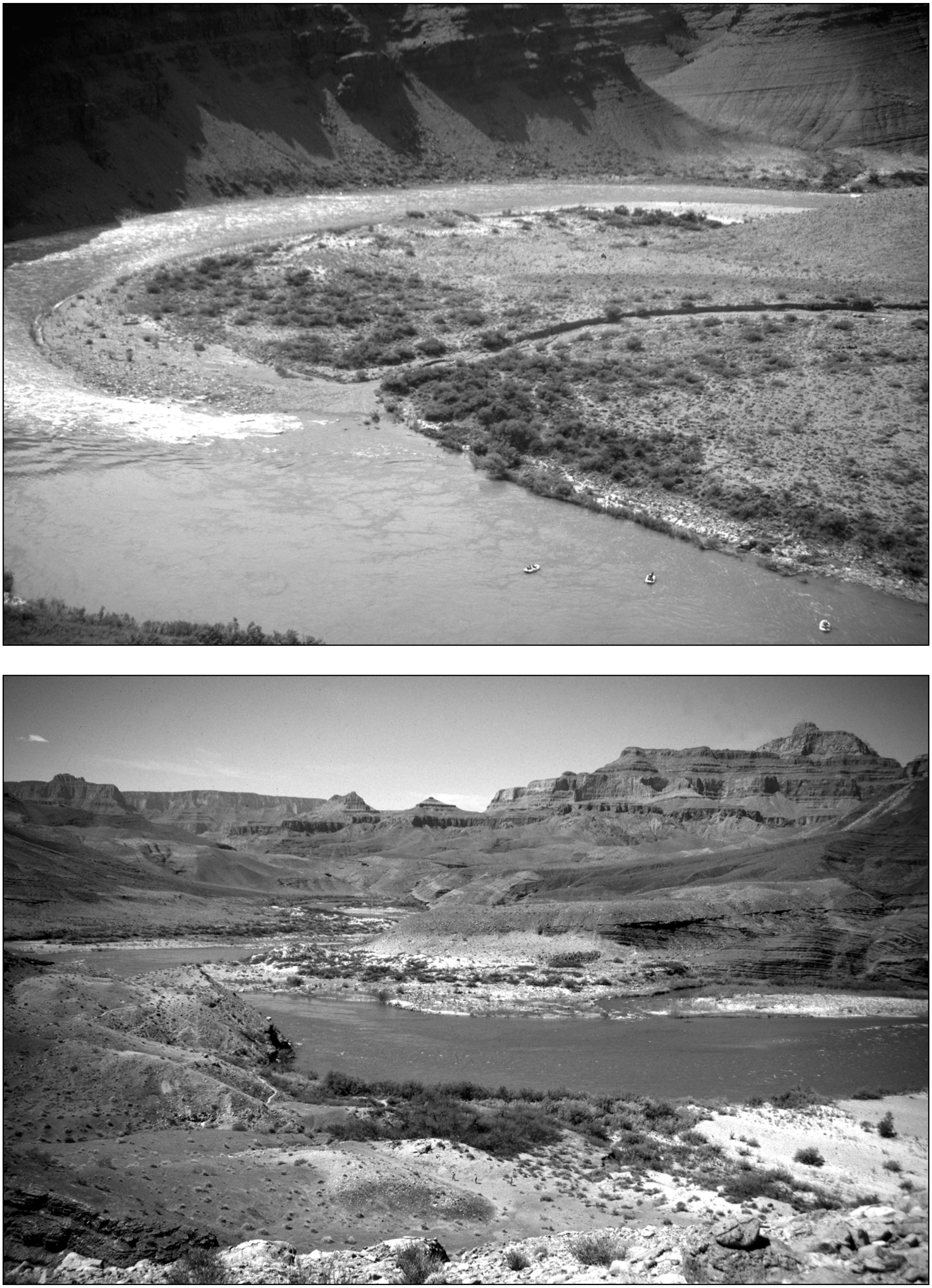

Figure 10. Reach 5: top, Unkar Delta from the air;
bottom, looking downstream from Tanner toward Basalt Creek.

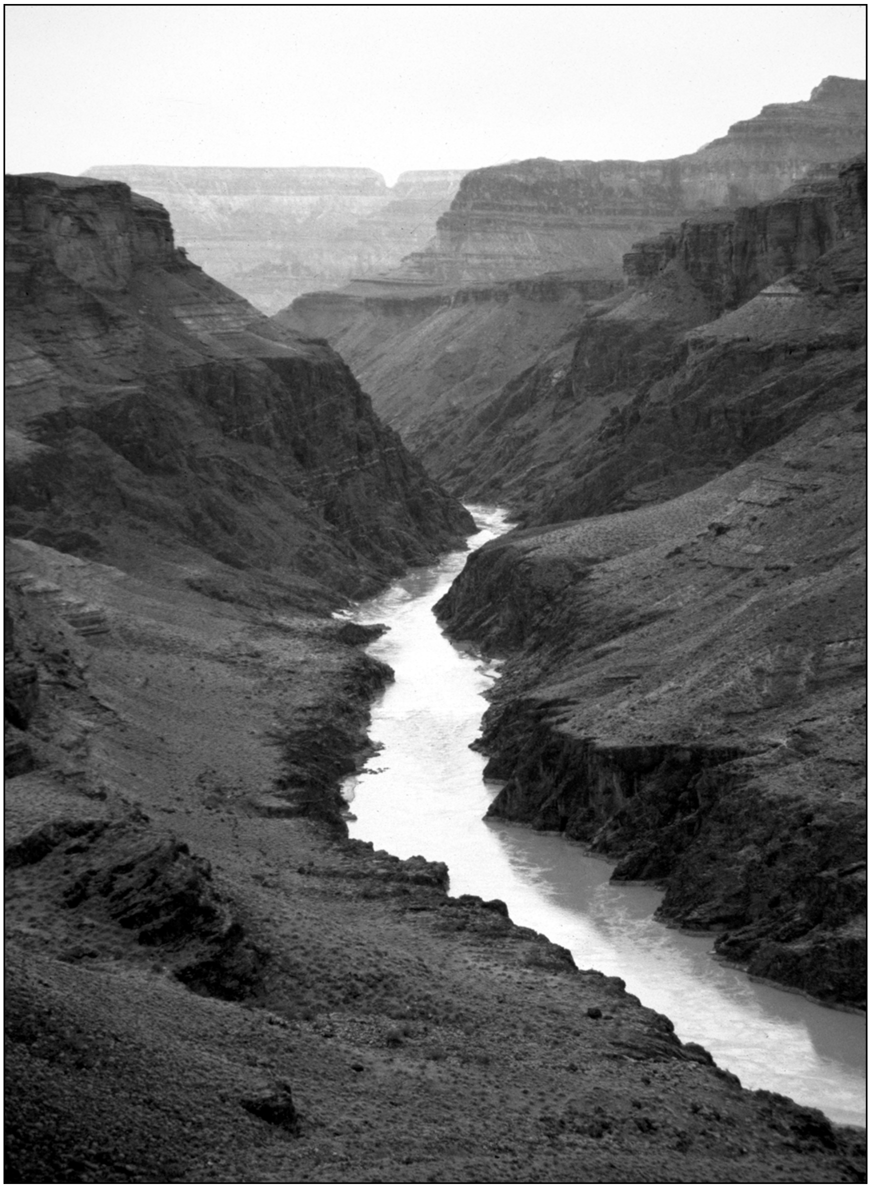

Figure 11. Reach 6, the Upper Granite Gorge.

Biotic Setting

The extreme elevational gradients in the Grand Canyon have made it possible for diverse biotic communities to exist within a relatively limited geographical area. Along the river and perennial sidestreams, a narrow band of desert riparian vegetation has become established in the 40 years following the construction of Glen Canyon Dam (Turner and Karpiscak 1980). In pre-dam times, the riparian zone adjacent to the Colorado River consisted largely of short-lived annuals and young perennial plant species prone to frequent disturbance by annual spring floods. Today, the absence of frequent, high-volume floods has allowed a dense growth of nonnative tamarisk to become established, along with native species, such as seep willow (*Baccharis* sp.) and coyote willow (*Salix exigua*) (Figure 14). Farther back from the river, in areas subject to infrequent inundation by exceptionally high floods, mesquite (*Prosopis pubescens*) and other disturbance-dependent species became established in pre-dam times. Today, this relict high-water zone appears to be descending in elevation and gradually diminishing because the periodic flooding has ceased. In side canyons where stand-replacing floods occurred less frequently, cottonwoods (*Populus fremontii*), box elders (*Acer negundo*), Goodding willows (*Salix gooddingii*), seep willow, and various other riparian shrubs and herbaceous plants inhabit the narrow stream side zones and provide an ecologically rich habitat for a wide variety of animal species.

Away from the water sources, there is a significant decline in biodiversity. Immediately upslope from the old high-water zone, desert-scrub communities dominate the terrain. Present-day dominant species on the talus slopes of Marble Canyon include shadscale (*Atriplex confertifolia*), ephedra (*Ephedra* spp.), narrow-leaf yucca (*Yucca angustissima*), prickly pear cactus (*Opuntia* spp.), and agave (*Agave utahensis*). In the central Grand Canyon, slopes are vegetated with many of the previous species, along with brittlebush (*Encelia farinosa*), goldenweed (*Haplopappus* sp.), fishhook cacti (*Mammillaria microcarpa*), and a barrel-like cactus called *Echinocactus polycephalus*. In the western Grand Canyon, dominant plants include creosote bush (*Larrea tridentata*), ocotillo (*Fouquieria splendens*), true barrel cactus (*Ferocactus acanthodes*), cholla (*Opuntia* spp.), and crucifixion-thorn (*Canotia holacantha*) (Stevens 1983:40). In geomorphically stable settings, a number of these perennial desert species have been found to persist in place for over a century (Webb 1996:47).

With increasing elevation, the desert biota is replaced by a succession of upland communities, including chaparral, pinyon-juniper woodlands, and ponderosa pine forest. At the highest elevations of the Kaibab Plateau, the forests are dominated by spruce-fir and associated alpine species.

The biotic landscape of the Grand Canyon has undergone a marked transformation in the 12,000 years or so that humans have been present in North America. Our knowledge of biotic change during the late Pleistocene and early Holocene, while still in its infancy, is nevertheless fairly robust, thanks in large measure to the study of pack-rat middens by Cole (1981, 1982, 1985, 1990), Phillips (1977), and Van Devender and Mead (1976). The recovery of Pleistocene faunal and fecal remains from dry caves (Euler 1984; Mead 1983; Mead and Phillips 1981) has also provided valuable sources of information about late Pleistocene environments in the Grand Canyon. They reveal an ecological landscape very different from the one we see today and provide insight into the amount and rate of environmental change that the Grand Canyon has undergone over the past 25,000 years. The pack-rat evidence is particularly compelling in that it reveals vegetative associations during the Pleistocene that are not duplicated in any settings within the canyon today (Cole 1990:245).

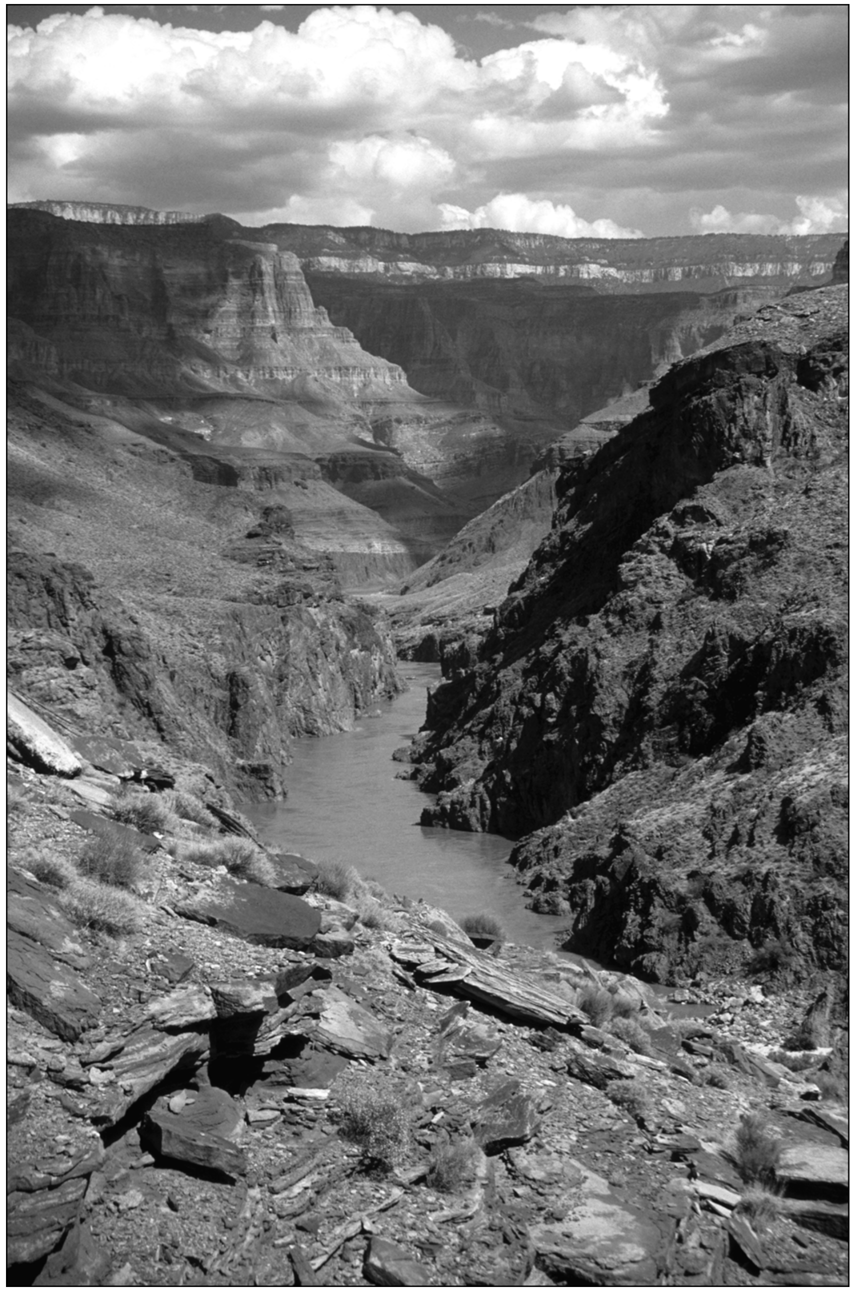

Figure 12. Reach 8, the Middle Granite Gorge, looking upstream from Deer Creek toward Stone Creek and the Powell Plateau.

Prior to approximately 12,500 years ago, species typical of more northerly latitudes occurred within the Grand Canyon at elevations 700–800 m below their current locations (Cole 1990:245). Southern species, such as pinyon pine (*Pinus edulus*) and ponderosa pine (*Pinus ponderosa*) that currently dominate the canyon rims, were either sparse or nonexistent during the late Wisconsin (Cole 1990:248), whereas along the river corridor in the western Grand Canyon, juniper (*Juniperus osteosperma*), blackbrush (*Coleogyne ramosissima*), and shadscale grew in lieu of the brittlebush, ocotillo, and creosote so common now (Cole 1990:245). During the late Wisconsin (ca. 12,000–25,000 years ago), these vegetative associations remained stable over an extended period of time, suggesting that vegetation had attained equilibrium with the prevailing climate (Cole 1990:253).

During the late Wisconsin–early Holocene transition 9,000–12,500 years ago, most plant species moved upward in elevation 600–1,000 m; the rapid shift in plants created new associations unlike those found either in the late Wisconsin or modern environments. Cole (1990:253) speculates that during this period of radical transformation, overall species richness may have diminished, "as some Pleistocene species were eliminated before their Holocene replacements arrived." Although the period of greatest "species flux" is bracketed between 8,000 and 12,000 years ago, the transformation to modern vegetative associations continued for at least another 2,000 years, until approximately 6,000 years ago. Some

Figure 13. Overview of the Granite Park area in Reach 10.

specific plant species, such as ocotillo, are still apparently adjusting to the prevailing climatic conditions. The packrat studies are valuable for demonstrating the degree of environmental change that took place during the Pleistocene-Holocene transition. They demonstrate that environmental conditions were anything but stable when human beings made their initial forays into the Grand Canyon region.

Holocene Geomorphology of the River Corridor

As discussed in the following chapter, surprisingly little attention has been paid to the youngest part of the Grand Canyon's geologic history beyond the immediate vicinity of the river channel. From an archaeological perspective, this is unfortunate, because Holocene fluvial and aeolian processes profoundly influenced decisions made by the area's prehistoric and historical-period inhabitants about where to live, farm, gather plants, and perhaps also when to stay or leave. Furthermore, these processes have greatly affected the preservation of—and our subsequent interpretations regarding—archaeological resources in the river corridor.

To understand the close relationship between geomorphology and archaeology in the river corridor, some basic background information about the pre-dam Colorado River is required. Prior to the construction of Glen Canyon Dam between 1957 and 1963, the Colorado River fluctuated dramatically on an annual basis, with flows often exceeding 85,000 cfs in late spring and dropping well below the median pre-dam discharge of 7,980 cfs in the dry fall months (Topping et al. 2003:52). Peak flows typically occurred in late May and June from melting of the snowpack in the Rocky Mountains. Secondary runoff peaks occurred in late July and August and also occasionally in midwinter months, because of localized storm events. The pre-dam flood flows carried tremendous sediment loads—over 1.8 million tons of sand, silt, and clay could be transported past a given point on a single day (Bob Hart, personal communication 1992). On average, roughly 76 million tons of sediment were transported past the gauge at Lees Ferry every year (Laursen et al. 1976; Schmidt and Graf 1988:39).

As flood waters receded each summer, the river would deposit sediment in recirculating backwater areas below the rapids, as well as along the riverbanks (Figure 15). In a typical year, the river would deposit massive amounts of sand, silt, and clay, which would

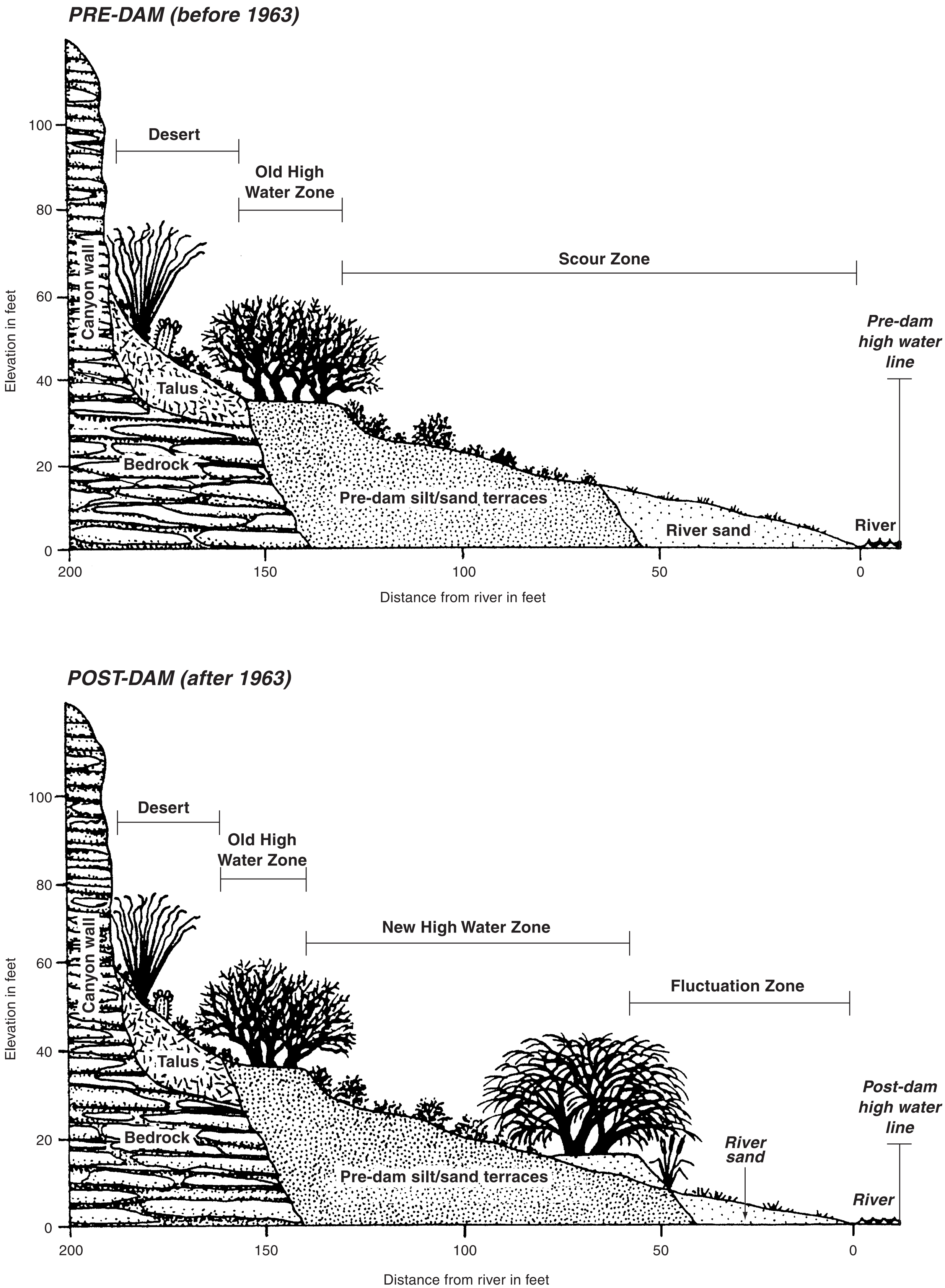

Figure 14. Schematic representation of new and old high-water zones. (Figure from *The Colorado River through Grand Canyon: Natural History and Human Change*, by Steven W. Carothers and Bryan T. Brown. © 1991 The Arizona Board of Regents. Reprinted by permission of the University of Arizona Press.)

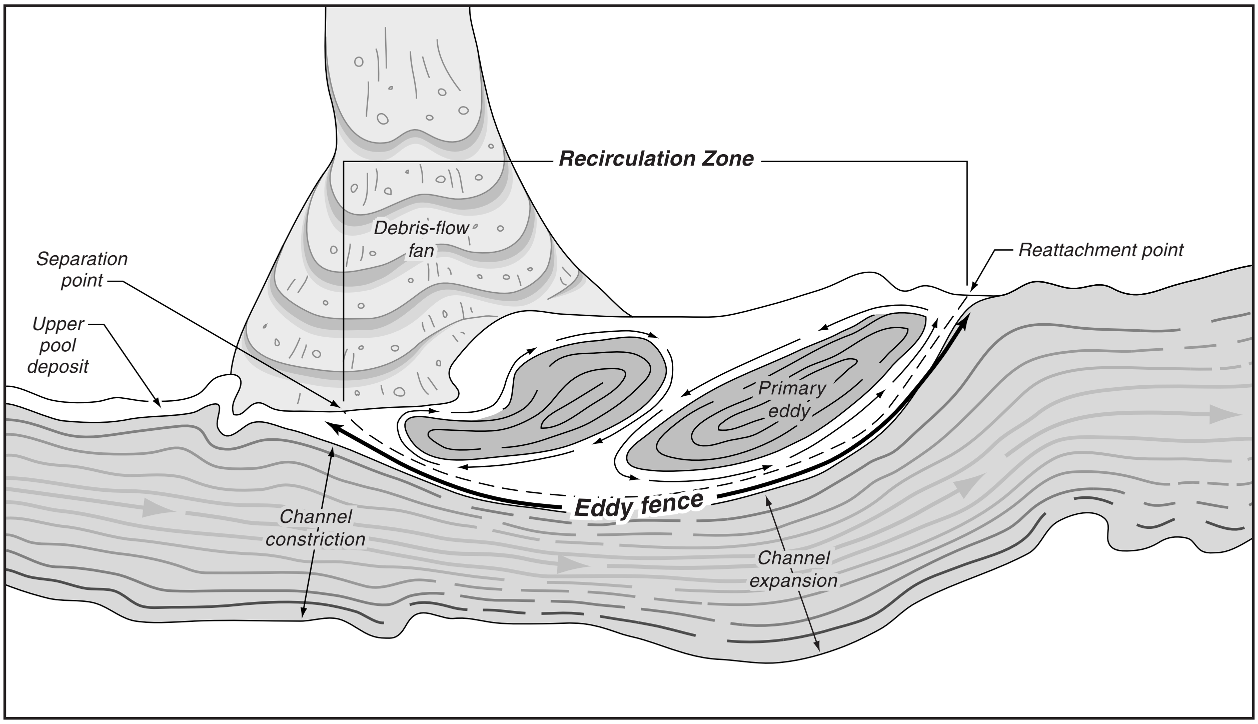

Figure 15. Diagram of eddy-fan complex, showing typical areas of sediment deposition in recirculation zones downstream of channel constrictions.

erode gradually (or sometimes rapidly) over the course of the following year, only to be replenished again in following years. In effect, this cyclical process maintained a dynamic equilibrium in sediment supply in certain reaches of the river corridor. However, over the long term (thousands of years), the river transported more sediment than it received from tributary inputs (Rubin and Topping 2001), resulting in progressive down-cutting of the channel and associated terrace deposits.

The geomorphology of the river corridor is influenced by the interaction of two separate but interconnected systems: the river's main stem and its numerous tributaries (Figure 16). In his overview of Colorado River sediment transport, Andrews (1991) notes that 85 percent of the river's discharge originates in the upper headwaters of the system, which comprises approximately 40 percent of the drainage basin area above the gauge at Bright Angel Creek, yet contributes less than one-third of the total sediment load. Most of the sediment that flows through the Grand Canyon enters the system via tributaries draining the central, semiarid portion of the Colorado Plateau. These include the San Raphael River, which flows into the lower end of the Green River, and the lower tributaries of the San Juan River, Paria River, and Little Colorado River. These rivers and their associated drainage areas contribute more than two-thirds (approximately 69 percent) of the sediment that moves through the Grand Canyon, yet this material is derived from only 37 percent of the total drainage basin. This same area contributes less than 15 percent of the total water volume. The importance of these relationships in deciphering sediment transport through the Grand Canyon is manifold (Topping et al. 1999), but one especially meaningful piece of information they reveal is that sediment supply and water volume are not necessarily proportional. In years when sediment input was high relative to water volume, the river channel would aggrade, whereas in years when water discharges were high relative to sediment supply, the opposite would occur. Furthermore, when spring floods occurred following years of sediment accumulation, extensive terraces would form following the flood recession. Under different circumstances (i.e., following years of sediment depletion), a flood of similar volume could cause extensive scouring of preexisting terrace deposits, rather than deposition (T. Melis, personal communication 2002).

Spring floods in excess of 85,000 cfs reoccurred, on average, once every two years, and floods with a peak discharge of 125,000 cfs reoccurred, on average, once every eight years (Topping et al. 2003:49). On rare occasions, significantly larger discharges flooded the river. USGS gauging records documented one flood of 170,000+20,000 cfs in 1921, and another estimated at 210,000+30,000 cfs occurred in 1884 (Topping et al. 2003:1). Furthermore, the geomorphological record indicates that at least one flood of approximately 300,000 cfs occurred in the 1,000-year span

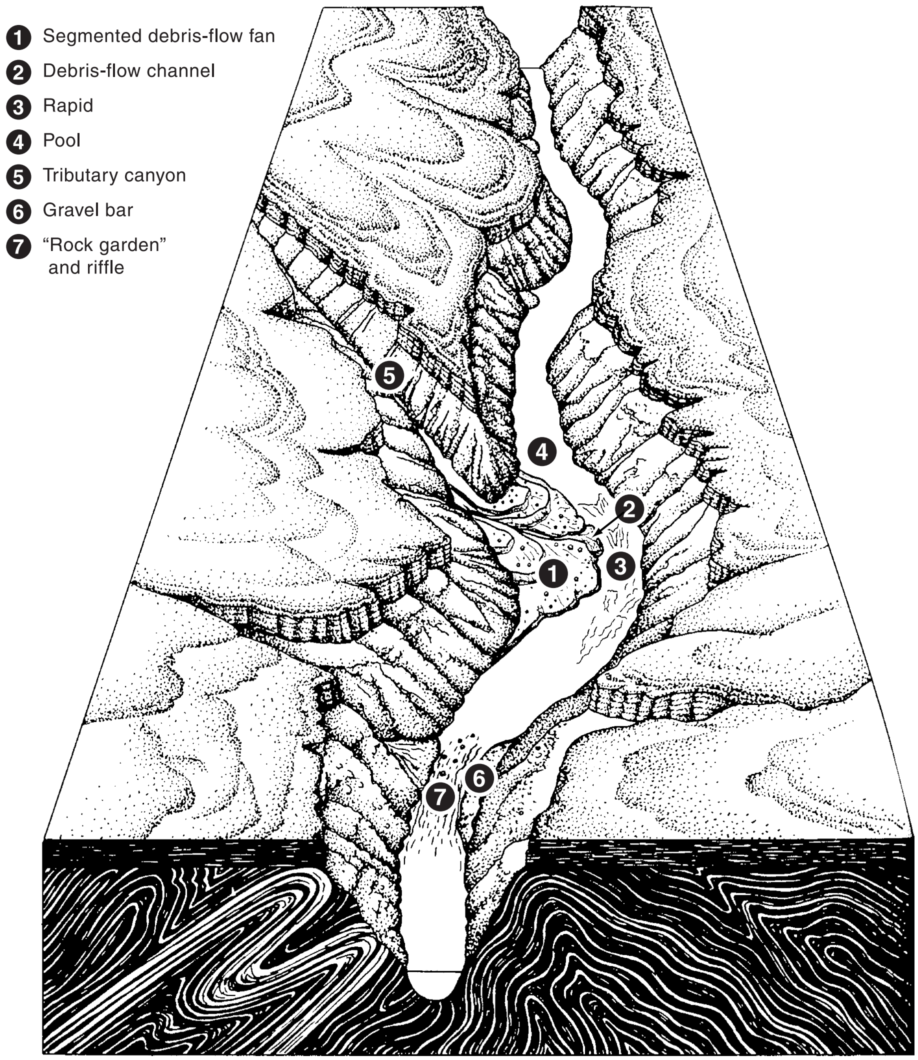

Figure 16. Block diagram showing relationship between terrestrial and riverine geomorphic features (after Carothers and Brown 1991).

preceding the 1884 event (Topping et al. 2003:49; cf. O'Connor et al. 1994). Sediment deposited by these exceptional floods could remain in place at higher elevations above the river for centuries, sometimes millennia. Subsequent floods carved into and reshaped these deposits, forming high terraces, and wind action reworked their surfaces, creating dunes. Occasional debris flows from side canyons overtopped and capped old terrace surfaces. Many of the high, sandy terraces were subsequently selected for habitation and specialized activity camps by prehistoric people. Of the 336 sites initially located in the areas that could potentially be affected by the operations of Glen Canyon Dam, approximately 240 are situated on or in alluvium deposited by the Colorado River (Fairley et al. 1994:148).

Based on fieldwork conducted between 1989 and 1994, Hereford et al. (1995) identified at least five temporally segregated sedimentary "packages" within an area mapped by Lucchitta et al. (1995) as the "Archeologic Unit." These packages form a series of terraces (Figure 17), with the oldest terrace usually highest and generally farthest from the river (although there are exceptions to this pattern). The terraces have inset geomorphic relations, such that younger terraces are typically topographically lower than older terraces; however, the units partially overlap in subsurface contexts. The areas of overlap between units represent depositional hiatuses or periods of erosion. The full suite of terraces is not present in any one locality, nor are the terraces paired across the river. Terraces are unpaired because the river usually flows between bedrock or talus on one bank and against alluvium and/or tributary debris-fan material on the other.

The two oldest Holocene deposits identified in the river corridor by Hereford et al. (1993, 1995; Hereford, Thompson, Burke, and Fairley 1996) are the Striped

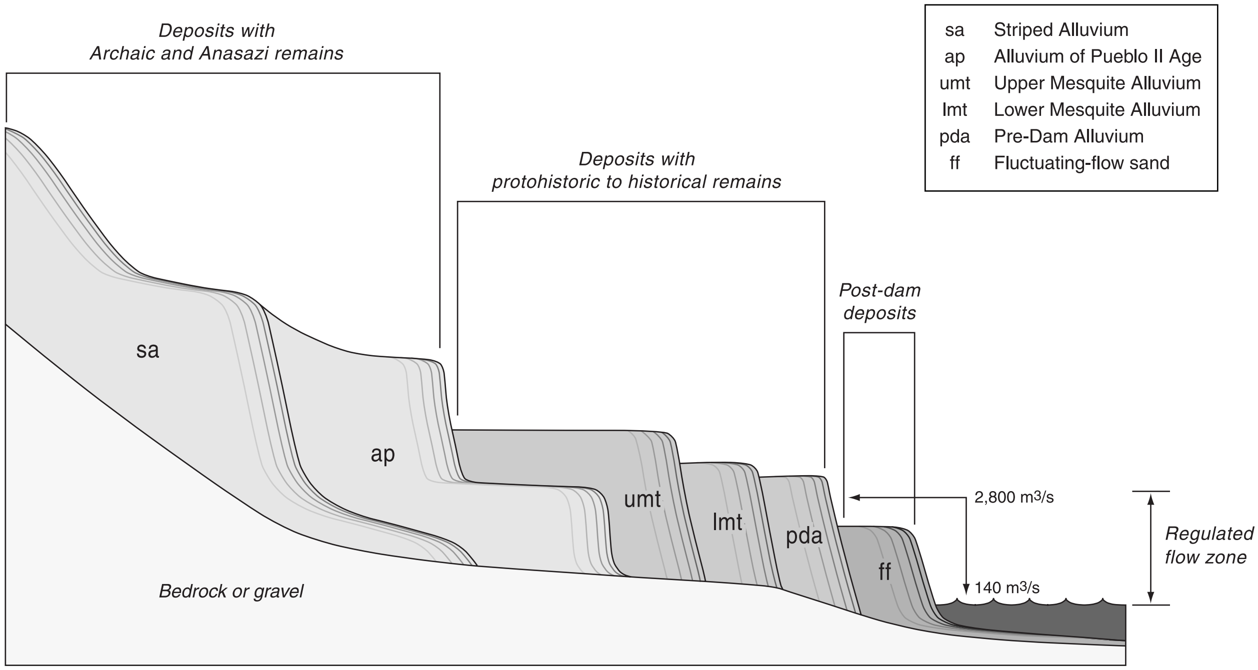

Figure 17. Schematic cross section showing geomorphology and stratigraphy of late Holocene alluvial deposits in the eastern Grand Canyon.

Alluvium and the Alluvium of Pueblo II Age. Prehistoric remains are found both on and in these deposits, but only aceramic remains are found within the Striped Alluvium. The Striped Alluvium consists of light-beige colored, very fine sand and silt interbedded with thin beds (5–15 cm thick) of dark-colored sand and gravel derived from nearby hillslopes. The relatively dark-colored slopewash material contrasts with the light-colored sandy bands, thereby imparting the distinctive "stripes" that characterize this deposit in the eastern Grand Canyon.

The Alluvium of Pueblo II Age derives its name from the locally abundant Pueblo II archaeological materials found on and near the surface of this deposit. However, artifacts diagnostic of the Pueblo I or Coconino Focus are found buried near its base, so in hindsight, a more accurate name would have been Alluvium of Pueblo Age. This deposit consists mainly of light-colored, poorly sorted, very fine-grained sand of fluvial origin interbedded locally with moderately well-sorted sand of probable aeolian origin. Occasional interbedded sand and gravel derived from adjacent hillslopes are also present, but they are not as conspicuous as those in the Striped Alluvium. In some places, the Alluvium of Pueblo II Age disconformably overlies the Striped Alluvium. The contact between the two units is an eroded surface with up to 1 m of local relief, and stratification in the Striped Alluvium is truncated at this contact. Thus, the Alluvium of Pueblo II Age is stratigraphically distinguishable from the Striped Alluvium, although in places there is little or no topographic separation at the surface.

The two Mesquite terraces—Upper and Lower—range from narrow, discontinuous scour zones to well-developed, easily discernible terraces. In the eastern Grand Canyon they are topographically below the terraces of the Striped and Pueblo II Alluviums. This topographic situation is unlike that found in the Granite Park reach, where Upper Mesquite Alluvium overlies the Pueblo-age terrace. As the names imply, abundant and relatively large, mature mesquites are present on the older, Upper Mesquite terrace, whereas markedly smaller and younger mesquite trees are present on the lower terrace. Like the Striped Alluvium and Alluvium of Pueblo II Age, the Mesquite terraces are composed of light-beige, very fine-grained, but poorly sorted silty sand of Colorado River origin.

Driftwood is present on the two Mesquite terraces but absent on the older terraces. Driftwood associated with the Lower Mesquite terrace contains less than 5 percent milled and cut wood. The paucity of milled and cut wood, the relative youth of the trees, and evidence derived from a 1890 Stanton photograph indicate that the Lower Mesquite terrace was probably deposited by the flood of July 1884, the largest flood of historical record, estimated at 210,000+30,000 cfs (Topping et al. 2003:1). In contrast, driftwood on the Upper Mesquite terrace is much rarer, decomposed, and consists mainly of beaver-cut cottonwood without milled or cut wood (Hereford et al. 1995, 1997; Hereford, Thompson, Burke, and Fairley 1996). Below the Lower Mesquite terrace and closer to the river are several additional strands of driftwood containing artifacts that have been correlated with the 1921, 1957, and 1983 floods.

The ages of the Striped Alluvium, Alluvium of Pueblo II Age, and Upper Mesquite Alluvium are based on radiocarbon dates and dendrochronologically cross-dated archaeological materials (Figure 18). In the eastern Grand Canyon, radiocarbon results indicate that deposition of the Striped Alluvium began prior to 800 cal B.C. and lasted until about A.D. cal 300 (Hereford et al. 1993, 1995). In the Granite Park area, an uncalibrated date of 2870 ± 60 B.P. (1260–1240 cal B.C. and 1220–910 cal B.C. with a 2-sigma confidence interval) from a deeply buried cultural strata indicates that deposition of the Striped Alluvium may have commenced sometime prior to 1300 B.C. (Hereford et al. 2000a). In upper Marble Canyon, even older dates are known. O'Connor et al. (1994:5) dated the base of a sequence that appears to be equivalent to the Striped Alluvium at approximately 2568–2289 cal B.C. The possible expanded age range of 2500 B.C.–A.D. 300 for the Striped Alluvium is consistent with the aceramic character of the archeological remains embedded within this deposit. However, further work may reveal an as-yet-unrecognized hiatus in deposition during this extended interval.

The deposition of the Pueblo-age alluvium probably began around A.D. 700. This date is suggested by the presence of Pueblo I–age ceramics near the base of the alluvium in the Upper Unkar area that cross-date at ca. A.D. 800–900. The ceramic assemblage includes Deadmans Gray and Floyd Black-on-gray, as well as Deadmans Black-on-red. A similar assemblage was also found in the Palisades area, stratigraphically separated from and underlying an early Pueblo II assemblage containing Coconino Gray, Medicine Black-on-red, and early versions of Black Mesa Black-on-white. Sites with late Pueblo II ceramics are common in the uppermost level of the Pueblo-age terrace, and early Pueblo III ceramics are found in a few locations on the surface of the terrace, suggesting that deposition of the alluvium ended between A.D. 1150 and 1200, more or less coincident with the depopulation of the Grand Canyon area. The period of erosion and nondeposition between the Striped Alluvium and Alluvium of Pueblo II Age appears to have lasted about 400 years, from about A.D. 300 to 700, coincident with the end of the Basketmaker II period and most of Basketmaker III.

Based on the lack of Anasazi ceramics, the alluvium of the Upper Mesquite terrace is clearly younger than A.D. 1200, an age supported by radiocarbon data as well as geomorphic relationships. Radiocarbon dates assigned to ancient mesquites and carbonized plant remains found in cultural features indicate that the deposition of Upper Mesquite Alluvium could have begun as late as A.D. 1400. Thus, the erosional hiatus between the Alluvium of Pueblo II Age and the Upper Mesquite Alluvium may have lasted for a period of about 200 years, between A.D. 1200 and 1400.

As noted previously, debris fans at the mouths of tributary canyons play a crucial role in the location and extent of Holocene sedimentary deposits in the river corridor (Howard and Dolan 1981; Schmidt 1990; Schmidt and Graf 1988). Early in the mapping phase of Hereford's project, it became apparent that the alluvial history of the river corridor could not be understood apart from the history of tributary debris-flow events. This is because debris flows create significant constrictions in the main channel, locally raising the river level upstream and creating new zones of deposition both upstream and in recirculation zones downstream of these constriction points. The magnitude and frequency of debris flows, some of which are extraordinarily large events (Melis et al. 1994; Webb et al. 1988, 1989), create localized base-level changes and determine subsequent patterns of sedimentation.

Most large debris fans in the Grand Canyon today, such as the ones at the mouths of Nankoweap, Palisades, Unkar, Prospect, and Granite Creeks, were initially formed during the late Holocene, more or less coincident with the deposition of the alluvial packages containing evidence of prehistoric human occupation (Burke et al. 2003; Hereford, Thompson, Burke, and Fairley 1996). Hereford recognized three major periods of fan-forming debris-flow events within the eastern Grand Canyon. The three debris-fan units were labeled dfo, dfi, and dfy (dfo being the oldest, dfi being of intermediate age, and dfy being the youngest). Based on the weathering characteristics of limestone clasts embedded within the fans, the ages of the alluvium associated with the fans, and the ages of artifacts and driftwood on the fans, as well as evidence from historical photographs, Hereford postulated that the three main periods of fan-forming debris flows occurred during the first few centuries B.C. for dfo, ca. A.D. 300–800 for dfi, and between A.D. 1880 and 1890 for dfy (Hereford, Thompson, Burke, and Fairley 1996). According to Hereford's interpretation, no major fan-forming events have occurred since the late nineteenth century; instead, recent debris flows historically have been largely confined to channels within existing fans, suggesting that the appropriate combination of climatic and physical triggers required for major fan-forming events have been lacking within the

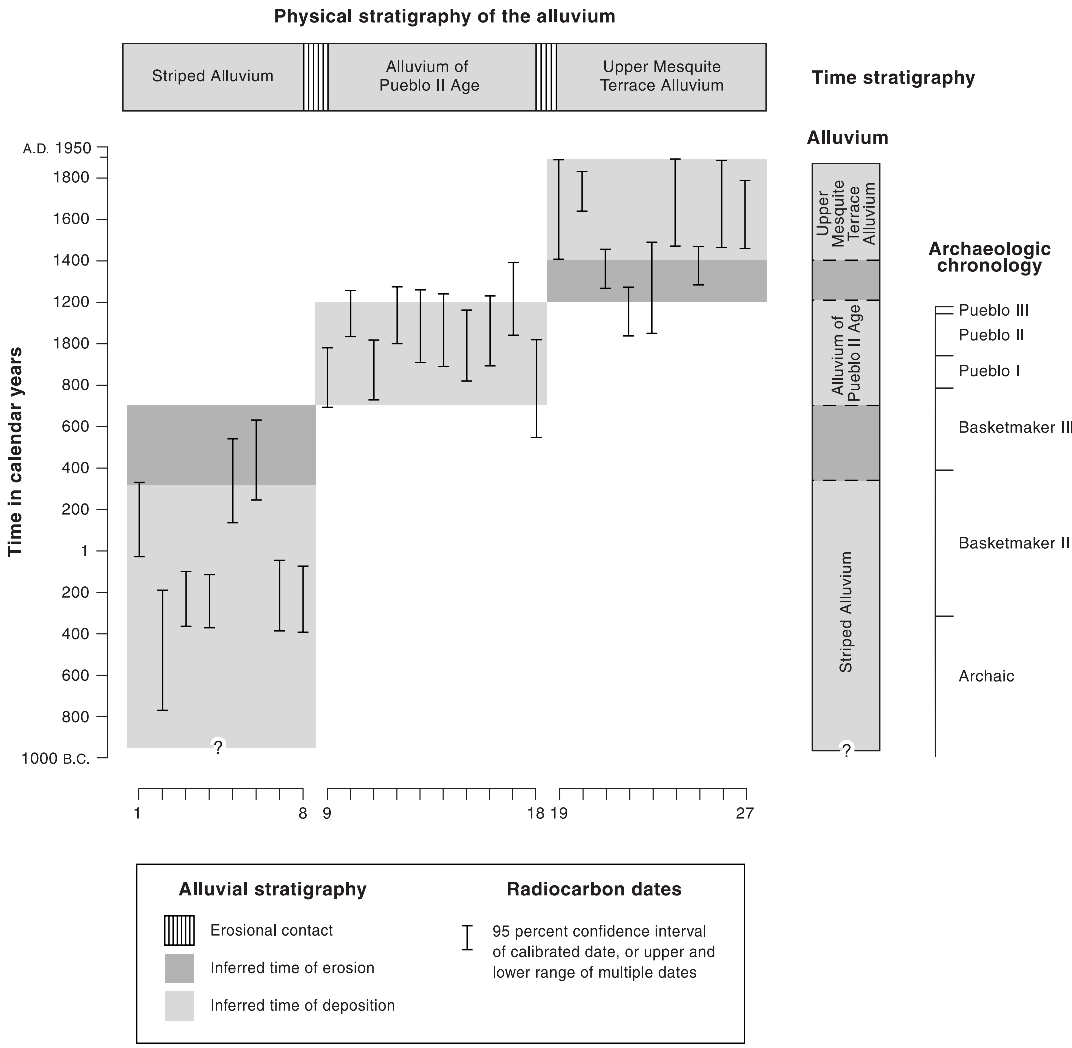

Figure 18. Alluvial terrace deposits correlated with radiocarbon dates in the eastern Grand Canyon (after Hereford, Thompson, Burke, and Fairley 1996:Table 3).

past century (cf. Griffiths et al. 1996). Hereford's distinction between fan-forming and channelized debris flows and the timing of major fan-forming events is not universally accepted by other geomorphologists working in the Grand Canyon river corridor (Robert H. Webb, personal communication 2002). Studies by Melis, Webb, and others suggest that debris fans form from multiple aggradational events over long periods of time and that fan aggradation is an ongoing process in the river corridor today (Melis and Webb 1993; Melis et al. 1994).

The construction of Glen Canyon Dam has profoundly altered some of the Holocene geomorphological processes that have been shaping the river corridor setting for thousands of years. Two of the critical changes brought about by the presence and operation of the dam include a dramatic alteration of the annual hydrograph (Topping et al. 2003) and a reduction of approximately 94 percent in the average annual sediment load in the uppermost reaches of the canyon (Rubin et al. 2002:278). These two principle factors have, in turn, produced myriad other changes in the physical and biotic components of the river corridor (Carothers and Brown 1991; Carothers and Dolan 1982; USDI 1996). One of the geomorphic research issues being actively studied and debated in the river corridor today concerns the extent to which the reduction in sediment availability, in conjunction with current dam operations, is causing or exacerbating the erosion of the pre-dam alluvial terraces where many of the archaeological sites are situated. A study conducted by Hereford et al. in the early 1990s led them to hypothesize that many surface drainages that cut across the high terraces are in the process of downcutting and regrading their channels to conform with the lower *effective* base level of the post-dam river (Hereford et al. 1993:44).

The "Hereford hypothesis," as it has come to be known, argues that in pre-dam times, annual spring floods deposited large quantities of sand along the riverbanks and frequently backfilled the mouths of tributary arroyos, resulting in temporary tributary base-level increases. Although the river level would drop after the spring floods receded and the active erosion of drainages would resume, the regular redeposition of flood sands maintained the surface sediments in a state of dynamic equilibrium, which prevented the wide-scale erosion of the terrace surfaces. The Hereford hypothesis has been criticized on a number of fronts, most notably because it does not adequately take into account the effects of aeolian processes and hillslope processes on past and present rates of erosion (Doelle 2000; Webb, personal communication 2002). Currently, in 2003, studies (Pederson 2000; Rubin 2003) are underway to look at these specific issues in terms of past, present, and future erosion of the pre-dam terraces.

Despite the ongoing controversies surrounding the issue of pre-dam terrace erosion, the geomorphic studies that have been completed in the Grand Canyon river corridor to date have important implications for interpreting the Grand Canyon's archaeological record. First, they emphasize how important it is to increase our understanding of the geomorphic processes that have affected the Grand Canyon so that we can appreciate the range and magnitude of the alterations that the landscape has been subjected to over time. The results of recent geomorphic studies underscore the importance of examining the full stratigraphic sequence of Holocene deposits in the river corridor, not just surface manifestations, to gain an understanding of the temporal depth and complexity of the Grand Canyon prehistory. At the same time, they demonstrate the need to more thoroughly document the spatial distribution of alluvial and aeolian deposits throughout the river corridor in order to reveal the extent to which the archaeological record may have been removed or modified by physical processes. Furthermore, the horizontal and vertical distribution of alluvial deposits obviously has an important bearing on our ability to interpret past cultural interactions within a regional context (Hajic 1985; Hajic and Styles 1982). These are some of the many research issues that could and should be addressed by conducting additional geoarchaeological studies and a more thorough analysis of the existing Holocene record in the Grand Canyon.

CHAPTER 3

Previous Research

This research design seeks to elucidate the complex physical and cultural relationships between people and the Grand Canyon, especially in the narrow band of land along the Colorado River known as the "river corridor." To develop this research design, it is necessary to know what people have thought and said about these relationships in the past and where their ideas originated. This chapter provides a summary of past research efforts in the Grand Canyon region, specifically relating to human use and modification of the river corridor, as well as to the nonhuman factors influencing landscape changes through time. Most of the following discussion focuses on the history of archaeological research in the river corridor. The history of ethnographic studies, historical studies, vegetation studies, and geomorphological research is also discussed, albeit less comprehensively.

Ethnographic Studies

Before the Glen Canyon Environmental Studies Phase II (GCES-II) program was initiated, there had been no studies that specifically focused on Native American perceptions of, or connections to, the Colorado River corridor in the Grand Canyon. This is not to say that long-standing and enduring relationships between southwestern tribes and the Grand Canyon were not recognized or documented to some extent in the past. Numerous references to the Grand Canyon are scattered throughout a large number of ethnographic publications—some more than a hundred years old (Euler 1958; Kelly 1964; Kroeber 1935; Powell and Ingalls 1874; Spier 1928; Stevenson 1904; Stoffle and Evans 1978). Until very recently, however, only one publication focused explicitly on the historical depth, breadth, and complexity of the relationships between a specific Native American tribe and the Grand Canyon, and that was Stephen Hirst's (1985) book on the Havasupai. Hirst initiated this research in the early 1970s to advocate for the return of Havasupai traditional lands in and around Grand Canyon National Park. In 1975, the effort was rewarded when the Havasupai regained access to some 95,000 acres of traditional-use lands within the park below the canyon rim, as well as 175,000 acres on the plateau above.

In general, references to the Grand Canyon in the older ethnographies tended to be brief, rarely more than a sentence or two, and often focused on past subsistence-related uses of the canyon (e.g., Kelly 1964; Spier 1928). With the exception of the Hopi, and to a lesser extent, the Havasupai (Hirst 1985) and Southern Paiute (e.g., Powell and Ingalls 1874), the tribes' spiritual and ideological connections to the Grand Canyon were rarely mentioned. In some cases, place-names and references to significant events that had occurred in the Grand Canyon were described exclusively with native words (e.g., Stevenson 1904), obscuring the connections to the Grand Canyon for English readers.

As a component of GCES-II, the Hualapai, Hopi, Navajo, and Zuni Tribes and the Southern Paiute Consortium carried out ethnographic research to document the significance of the Grand Canyon and its resources to each tribe. Some of the results of this research are available in documents with limited distribution (Ferguson 1997; Hart 1995; Hualapai Tribe 1993; Roberts et al. 1995; Stoffle et al. 1994). Other results have not been made available to the public (Jonathan Damp, personal communication 2002; T. J. Ferguson, personal communication 2001).

The published studies document rich and varied cultural traditions. Many stories and diverse meanings have been ascribed to the place as a whole, as well as to specific features and locations within the Grand Canyon. Chapter 4 presents a very brief synopsis of this research. Much more information is presented in the tribes' individual reports, and these should be consulted for further details.

Historical Research

There are numerous publications documenting the Euroamerican history of the Grand Canyon (e.g., Anderson 1998, 2000; Darrah et al. 1948–1949; Hughes 1978; James 1900; Pyne 1982, 1999; Verkamp 1940). The few dealing specifically with the river corridor have tended to focus primarily on river-running history (e.g., Crumbo 1981; Lavender 1985) or river-management history (Fradkin 1996). A couple of notable exceptions include a historical-ecology study by Webb (1996) and a summary of historical archaeological sites in the river corridor by Coder (1994). Webb's study documents environmental stability and change within the river corridor based on comparisons of modern photographs with those taken by the Stanton expedition a century earlier. Webb examines the relationship of past and present environmental conditions to historical activities, such as livestock grazing, river running, and dam building, as well as to natural historical events, such as floods and frosts. Coder's chapter in the river-corridor archaeological survey report (Fairley et al. 1994:113–150) provides an overview of Euroamerican history in the river corridor as it relates to the various historical archaeological remains located during the 1990–1991 archaeological inventory. All of these studies contribute useful insights into recent historical human uses of and modifications to the river-corridor environment and serve as a foundation for future research related to the historical remains found there.

Two other recent historical studies that are particularly relevant to the focus of this research are Stephen Pyne's (1999) book, *How the Canyon Became Grand: A Short History*, and Barbara Morehouse's (1996) *A Place Called Grand Canyon: Contested Geographies*. Pyne's work explores the history of changing Euroamerican concepts about the Grand Canyon. He demonstrates how our modern-day perception of the Grand Canyon has been shaped by the ideological evolution of American culture over the past hundred years and more. Early Euroamerican visitors to the Grand Canyon did not view the canyon as a cultural icon in the way that many modern tourists do today. Initially, they viewed it as an impediment and a barrier to travel; later, it was depicted as an unexplored wilderness in need of conquering. During the latter part of the nineteenth century, local settlers viewed it principally as resource-extraction zone. Pyne demonstrates how our current notion of the Grand Canyon as a geologic wonderland and a wilderness of great beauty, inviting spiritual contemplation and personal discovery, is a historical product of the romantic era, overlain with a veneer of modern-day environmental values. Morehouse's book explores the history of the relationship between the NPS and the Havasupai Tribe. Specifically, it examines the historical circumstances that led to the creation of Grand Canyon National Park on traditional Havasupai lands, how the Havasupai fought to regain control of these lands, and how this history eventually resulted in the current boundaries on the landscape. In essence, it is a case study that provides the historical context for the transformation of one cultural landscape into a very different kind of cultural landscape over the course of a single century.

Vegetation Studies

Several nineteenth-century Euroamerican explorers made brief notes about the vegetation along the Colorado River (e.g., Bigelow 1856; Powell 1875; Smith and Crampton 1987), but it was not until 1938 that a comprehensive floristic inventory of the river corridor was attempted. In that year, botanist Elzada Clover and her student, Lois Jotter, accompanied Norm Nevilles on his first expedition through the Grand Canyon. Although much was made of the fact that this was the first Grand Canyon river expedition to include female participants, their presence on the trip was not just intended to make history, as their purpose was to collect plants and describe their distributions. The results of this field expedition and subsequent work completed during a canyon hike in 1939 were published a few years later (Clover and Jotter 1944). For 30 years thereafter, this was the standard reference on the vegetation of the river corridor. Several plant lists were compiled for the Grand Canyon during the following decades (Deaver and Haskell 1955; Gaines 1960; McDougall 1947; Phillips 1975; Phillips and Phillips 1974).

During the mid-1970s, the focus of vegetation studies shifted, and increased attention was directed toward understanding the effects of Glen Canyon Dam on the downstream ecosystem (Dolan et al. 1974). This led to a series of detailed studies documenting post-dam changes to the river-corridor vegetation (Carothers et al. 1979; Karpiscak 1976; Phillips et al. 1977; Turner and Karpiscak 1980). These studies revealed pronounced and profound changes in the density, distribution, and composition of the riparian zone. For example, in 1938, Clover and Jotter (1944) had noted that the zone of moist sediment immediately adjacent to the river was characterized by "little climax vegetation" owing to "constantly changing conditions . . . of the river's edge in consequence of periodic floods." Turner and Karpiscak's examination of pre-dam photographs confirmed "the near absence of plants in this situation." When these photographs were compared with conditions in 1976, however, Turner and Karpiscak found "that in the short period of 13 years [since closing of the Glen Canyon Dam bypass tunnel] the zone of post-dam fluvial deposits ha[d] been transformed from a barren skirt on both sides of the river to a dynamic double strip of vegetation" (Turner and Karpiscak 1980:19).

With the initiation of the GCES, the pace of research on the river corridor vegetation increased exponentially (see Johnson [1991] for a summary of vegetation studies through the 1980s; see also Stevens and Ayers [1993]; Stevens et al. [1995]). Most of these studies were concerned with documenting short-term changes in the vegetation following the construction of Glen Canyon Dam or with documenting the current ecological conditions. One exception to this focus, however, was the work carried out by Robert Webb (1996), following Turner's historical photo-replication techniques. Using the extensive photographic record of the 1889–1890 Stanton expeditions as his baseline, Webb precisely replicated the views a century later and then analyzed the visible changes. Webb's study confirmed many changes in the vegetation over the past century, not only in the zone immediately adjacent to the river corridor, but also in desert areas well removed from the river. He attributed most changes to a combination of livestock-grazing impacts, debris-flow events, changes in the hydrologic regime from damming, and episodes of severe frost. At the same time, Webb documented a remarkable amount of stability in the vegetation, especially outside the riparian corridor, in areas of the canyon where burros had not grazed extensively (Webb 1996:98). He concluded that human beings were an important agent of change in the river corridor, but that anthropogenic impacts were not qualitatively different from the other agents of change operating within the river corridor (Webb 1996:86). Webb therefore argued that humans and their impacts should not be treated as though they were an "unnatural" component of an otherwise "natural" system but rather should be viewed as an integral component of the ecosystem.

History of Archaeological Research along the Colorado River below Glen Canyon Dam

John Wesley Powell (Figure 19) is the individual most often credited with bringing the cultural resources of the Grand Canyon to the attention of the world (Fowler et al. 1969). During his first trip through the canyon in 1869, and during his second trip in 1871–1872, Powell (1875) observed and then commented on several ruins and associated artifacts that he and his men found near the mouths of tributary streams. Euler (1969a) subsequently identified and recorded the ruins noted by the Powell expeditions at the mouths of the Little Colorado River (AZ C:13:4), Hance Creek (AZ C:13:5), Bright Angel Creek (AZ B:16:1), Crystal Creek (AZ B:16:3), and Shinumo Creek (AZ B:15:1), as well as other sites located farther from the river near Cardenas Creek (AZ C:13:2) and up Tapeats Creek (AZ B:11:38 and B:11:39). Having no sense of the time depth represented

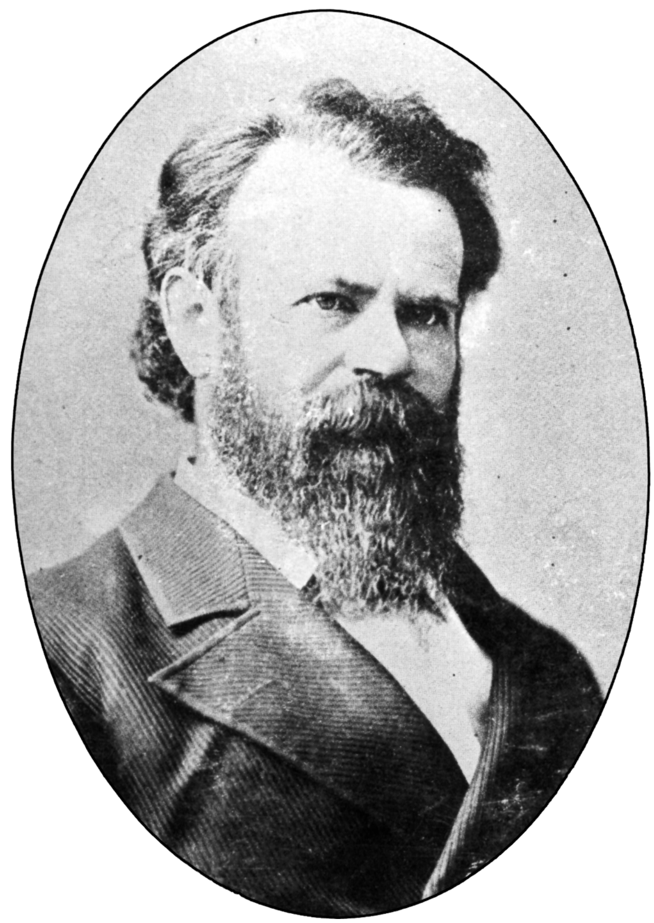

Figure 19. John Wesley Powell.

by these ruins, Powell assumed that they were relatively young. He suggested that they may have been created by Puebloan refugees escaping Navajo and Spanish aggression in the sixteenth and seventeenth centuries (Powell 1961:260). In his field notes, Powell commented on the presence of trails "deeply worn in the rock" near the mouths of the Little Colorado River and at Bright Angel Creek (Figure 20). Altogether, Powell and his men located at least eight archaeological sites during the two trips. Powell ascribed all of the sites to "Moquis" (Pueblo people), although several members of his expedition thought that either Apache, Navajo, or Co-o-me-nes (Havasupai) might have been responsible for some of the remains (Darrah 1947:61; Gregory 1948–1949:147; Kelly 1948–1949:442).

During the 1869 expedition, Powell's men discovered an "Indian garden" under cultivation downstream of Lava Falls (presumably planted by the Southern Paiute). On the 1872 trip, Frederick Dellenbaugh (1984:224) encountered a small hut of mesquite logs somewhere in the vicinity of Basalt or Unkar Creeks. Neither of these historical-period sites have been positively identified by archaeologists. Euler (1969a:18) thought that the garden was located in the vicinity of Whitmore Wash, although some river runners (e.g., Drifter Smith, personal communication 1987) believe Spring Canyon would have been a more likely candidate. Euler considered the mesquite log hut near Unkar to have been a Southern Paiute dwelling. He based this partly on an assumption that the hut was located north of the river, although Dellenbaugh never specified this. One probable protohistoric Paiute site (with Hopi Jeddito Yellow Ware ceramics) is known to be present in the middle of Unkar Delta, and it is possible that this was the site that Dellenbaugh observed; however, the possibility that the hut was on the south side of the river and potentially built by an early Anglo prospector cannot be ruled out.

Twenty years after Powell, in July 1889, Robert Brewster Stanton and associates (Figure 21) undertook a survey of a railroad route through the Grand Canyon (Smith and Crampton 1987). The first trip was aborted after 3 of the 10 men drowned in the first 25 miles below Lees Ferry. The remaining men hiked out at South Canyon after stashing their supplies and equipment in a large limestone-solution cavern, which later came to be known as Stanton's Cave (AZ C:5:3). On the way out of the canyon, they passed by a series of ruined structures now known as AZ C:5:1. Stanton and a fresh group of recruits returned the following winter with life jackets and made a successful journey through the canyon. Stanton, who relied on Powell's notes to track his progress through the canyon, relocated four of the sites originally noted by Powell and his men (AZ C:13:2, AZ B:16:1, AZ B:16:3, and AZ B:15:1). In addition, he located several previously unrecorded ruins, including the granaries at Nankoweap (AZ C:9:1), a site on a pinnacle above the Bright Angel Creek Ruin (no site number), granaries near 110 Mile (AZ B: 15:91), and an alcove site overlooking the river below Deer Creek (AZ B:10:1). It is interesting to note that he did not comment on the ruins at Unkar Delta, although his journal indicates that he hiked up to the ridge overlooking the mouth of Unkar Creek and must have passed by several along the way.

Aside from providing the first records of prehistoric sites in the Grand Canyon, the Powell and Stanton expeditions were responsible for creating some of the earliest Euroamerican historical-period sites in the river corridor. The Stanton party was particularly prolific in this regard, carving inscriptions above Paria River (AZ C:2:105), near the spot where Frank Brown drowned (AZ C:6:2) (Figure 22), in a tree near 23 Mile (AZ C:5:7), and above the spot where the remains of Peter Hansborough were buried (AZ C:9:30). They may also have been responsible for the creation of a late-nineteenth-century equipment cache (Smith and Crampton 1987:84) that was later found by members of the 1923 USGS survey expedition near 25-Mile Rapid (AZ C:5:4), although Euler (following Marston 1949) attributed this site to a late-nineteenth-century prospector named Frederick T. Barry. By comparison, the Powell expeditions left few signs of their passage through the inner canyon. Only one site, a rockshelter near Mile 122 with some constructed slab steps, has been tentatively associated with the Powell expedition of 1872 (Coder 1994:115).

During the next 50 years, river-running journals continued to include passing references to Indian ruins and artifacts from time to time. Probably the most noteworthy archaeological discovery in the river corridor during the first half of the twentieth century was made by the 1934 Bus Hatch expedition. While exploring the cave where Stanton had cached his gear in 1889 (Figure 23), Bus Hatch found a number of curious-looking split-twig figurines (Webb 1989:45–46). Some of these were later turned over to Clark Wissler at the American Museum of Natural History, who brought them to the attention of professional archaeologists. The Hatch party also found the skeleton of an individual clad in buckskin on a ledge not far from the cave (Webb 1989:45). Unfortunately, someone on the trip removed the skull (Reilly 1966), obscuring forever the ethnic identity of the individual.

Meanwhile, professional archaeologists began exploring the Grand Canyon region in the 1920s. Most of the early archaeological investigators concentrated their explorations on the North and South Rims (Amsden ca.

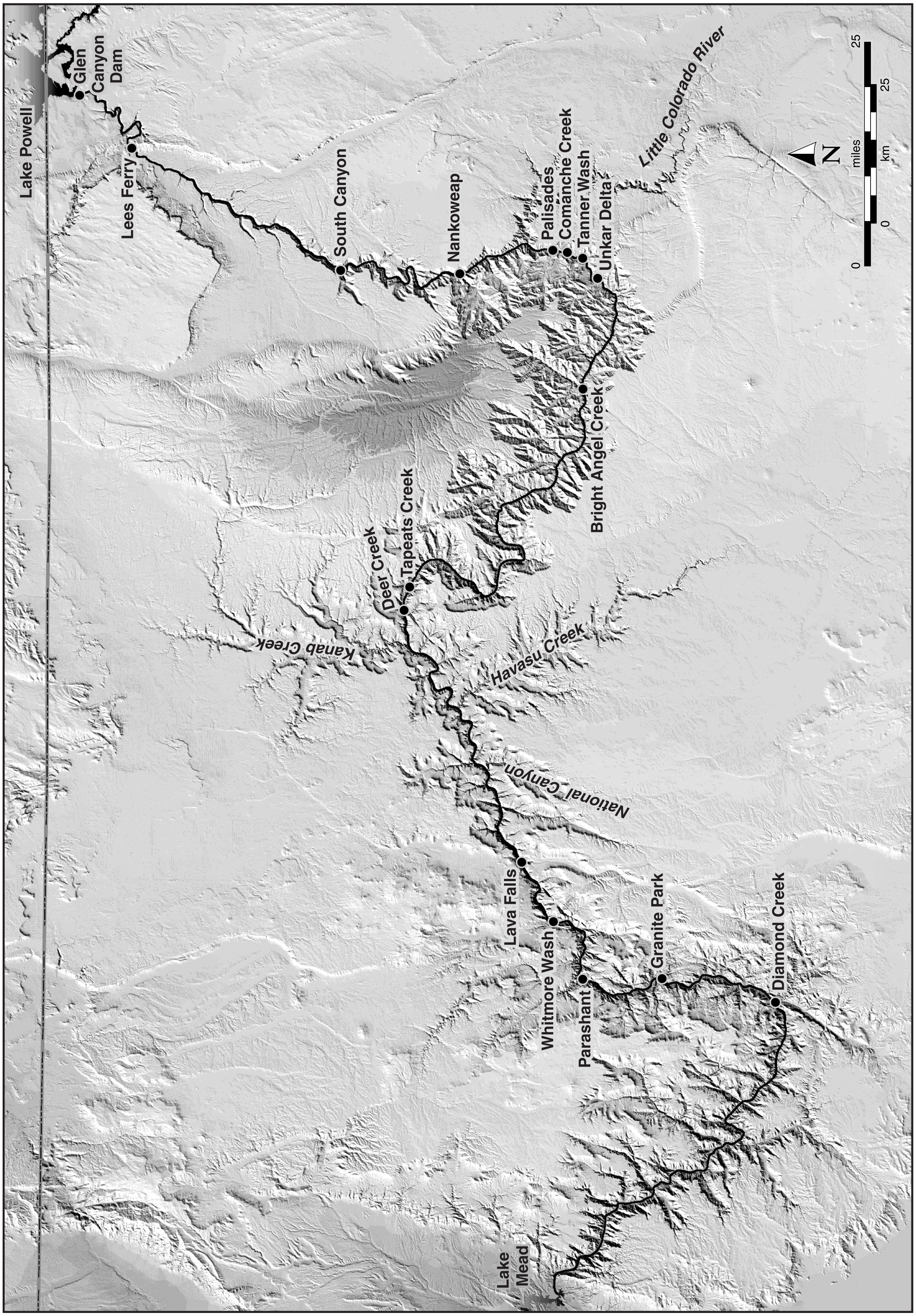

Figure 20. Principal locations discussed in the text.

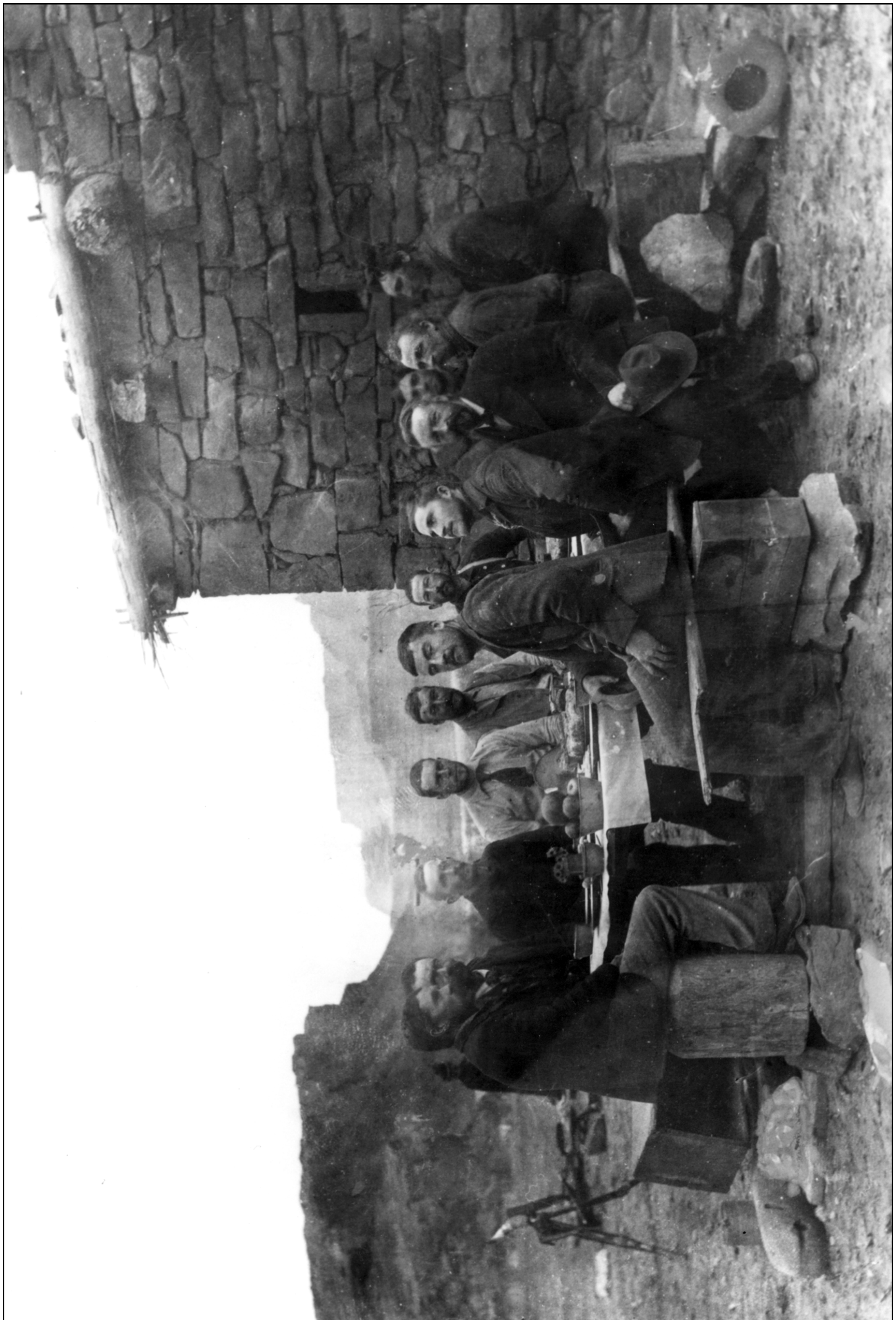

Figure 21. Robert Brewster Stanton and his men at Lees Ferry, December 25, 1889, shortly before embarking on their second attempt to survey a railroad route through Grand Canyon (courtesy of Walter Havighurst Special Collections, Miami University, Oxford, Ohio).

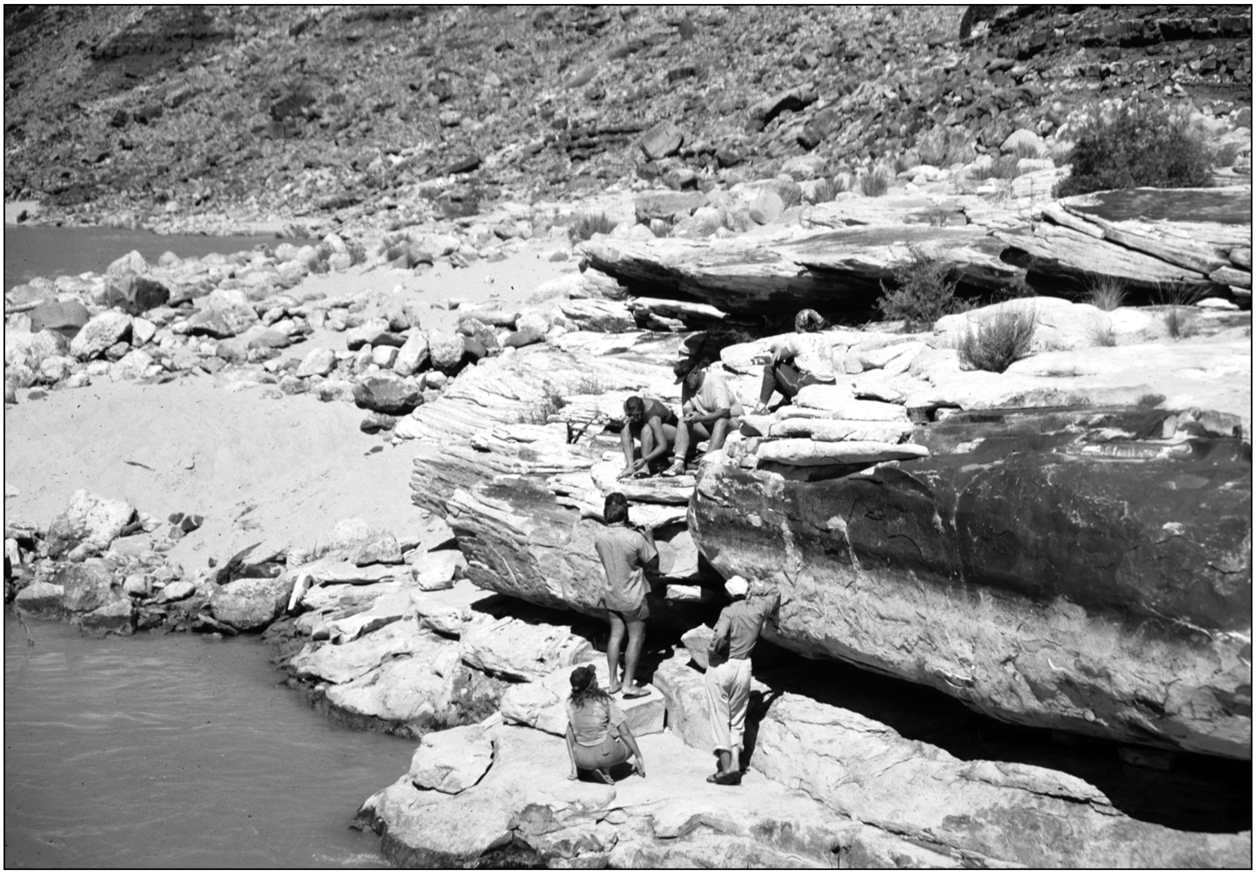

Figure 22. National Park Service personnel examine the Brown Inscription, AZ C:6:2, below Soap Creek Rapid (photograph by Helen Fairley).

1932; Baldwin 1978; Hall 1942; Haury 1931:2; Judd 1918, 1919, 1926). One notable early exception was the 1923 Milwaukee Public Museum expedition, which went down Bright Angel Canyon from the North Rim as far as the Colorado River (West 1925). During the late 1920s and early 1930s, NPS rangers undertook a series of exploratory hikes in remote portions of the park and returned with stories of abundant ruins (Brown 1929; Collins and McKee 1931; Hastings 1930; Sturdevant 1928). These reports prompted Russell Hastings, an NPS naturalist and former employee of Gila Pueblo, to undertake additional surveys in the backcountry. In 1931, Hastings conducted a reconnaissance of the Bright Angel corridor, and in 1935, he supervised four Civilian Conservation Corps laborers on a reconnaissance survey of the upper Nankoweap Valley (Grand Canyon National Park site records). This group came down to the mouth of Nankoweap Creek, making the first formal records of the archaeological remains in that area. All these early inventories were descriptive in nature and were focused on documenting ancestral Pueblo sites, including pueblos, granaries, checkdams, and petroglyphs.

The first archaeological expedition to focus specifically on the Colorado River corridor below the current site of Glen Canyon Dam took place in July 1932 under the leadership of Julian Steward (1941). Steward was interested in archaeological manifestations of what was then known as the "northern periphery" (of the Anasazi heartland). During his reconnaissance of the river corridor between Hite, Utah, and Lees Ferry, Arizona, Steward documented 28 sites in Glen Canyon and 1 in Paria Canyon, but none in the stretch below Wahweap Creek to Lees Ferry. The Steward river trip was followed by a series of boat-supported archaeological survey trips through Glen Canyon sponsored by the Rainbow Bridge–Monument Valley expedition in 1933, 1934, and 1935; however, no sites were recorded in the 15-mile stretch above Lees Ferry until 1952, when an amateur archaeologist and river runner named Gene Foster undertook additional surveys in that area (Adams et al. 1961). After 1956, Foster's work became part of the accelerating data-recovery efforts of the Glen Canyon Archaeological Project (GCAP) (Jennings 1966).

After initial surveys performed in advance of the Glen Canyon Dam construction project by Museum of Northern Arizona (MNA) archaeologists (Adams et al. 1961), little attention was paid to the sites below the dam construction site. During the first few years of the GCAP

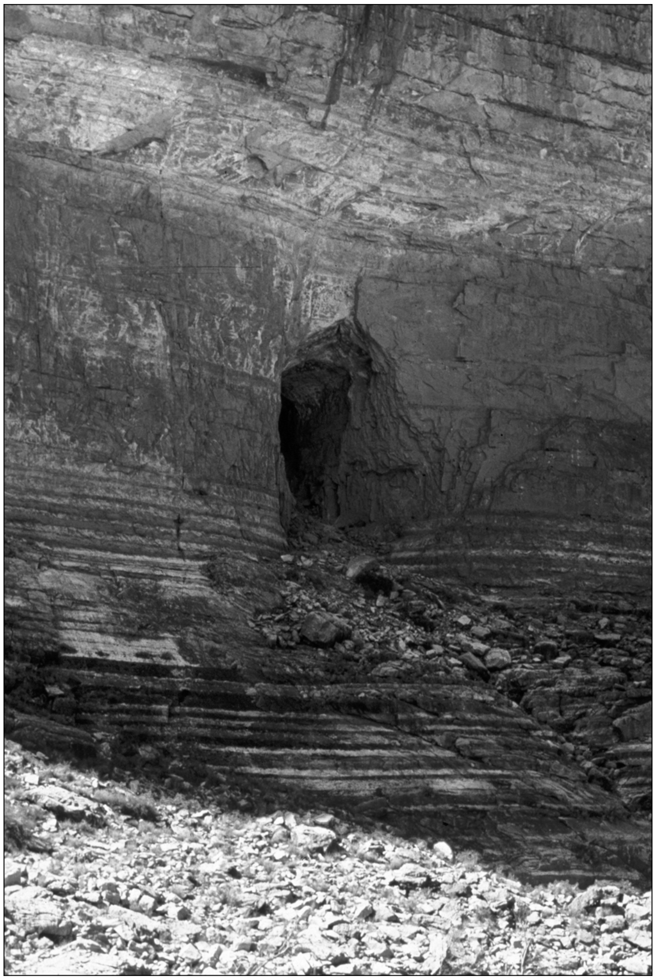

Figure 23. Stanton's Cave in Marble Canyon (photograph by Helen Fairley).

(1957–1959), work focused on upstream sites adjacent to the river corridor. Researchers soon concluded that most of the low-elevation sites along the river represented short-term seasonal occupations by Puebloan farmers residing on the adjoining plateaus. During the later years of the GCAP, researchers turned most of their attention to the adjoining highlands, where more-substantial remains indicative of permanent habitation could be found. As a result of focusing on ceramic-age structural sites and concentrating later research outside the river corridor (and also, in part because of Dr. Jennings' reluctance to spend limited project dollars on expensive radiocarbon dating), the extensive preceramic occupation of inner Glen Canyon was largely overlooked. This gap in understanding continued for 30 years, only coming to light in the late 1980s as a result of Northern Arizona University's (NAU) NPS-sponsored research in the area (Geib 1996). NAU researchers greatly benefited from the three decades of additional research that had been carried out before the mid-1980s in surrounding areas of the Colorado Plateau, especially the work of Jennings and his University of Utah students on the northern Colorado Plateau (Jennings 1978, 1980; Jennings et al. 1980; Schroedl 1976, 1977) and Ambler's work at Dust Devil Cave and Sand Dune Cave in the Navajo Mountain region (Lindsay et al. 1968).

Despite decades of research upstream in Glen Canyon, the archaeology of the Colorado River corridor below Lees Ferry remained largely unexplored by professional archaeologists until July 1953, when Dr. Walter W. Taylor, a research associate of the Smithsonian Institution, was invited to join a group of natural scientists from the University of Arizona on a reconnaissance survey through the Grand Canyon. The NPS had specifically requested that an archaeologist accompany the trip to provide an assessment of the archaeological potential of the area slated for inundation by the proposed Bridge Canyon Dam (Taylor 1958:18). Although the logistical constraints of this seven-day, multipurpose motor trip limited the amount of information obtained, Taylor nevertheless managed to locate and record archaeological sites in five separate areas of the river corridor: South Canyon, Nankoweap, Unkar, Bright Angel, and Deer Creek. By this time, all of these archaeological localities were well known to river-running expeditions, although few of them had been formally documented.

Although Taylor was hesitant to pass judgment based on "so hasty and restricted a survey" (Taylor 1958:23), he nevertheless concluded that most of the river corridor was unsuited to human habitation because of the confined topography and limited access from the rim. It should be noted here that Taylor was primarily concerned with Puebloan sites. This bias is evident in his observation that "subsistence opportunities would have been good to excellent" in the section of river corridor between Nankoweap to Unkar, because of the fact that "the canyon is quite open, the river accessible, and a flood plain [*sic*] present," whereas in the section from Unkar to Bright Angel "the canyon again closes in. Access is difficult or impossible, and there are no places where occupation or agriculture would have been feasible."

Around the time of Taylor's reconnaissance, two other archaeologists made their initial appearance in the Grand Canyon. In the summer of 1949, a young undergraduate student named Douglas W. Schwartz traveled from Illinois to assist John C. McGregor, a professor at the University of Illinois and an associate of the MNA, in the excavation of several Cohonina sites near Williams, Arizona, and Grand Canyon National Park (McGregor

1951). McGregor was interested in expanding on the pioneering work of Lyndon Hargrave (1937, 1938) and Harold S. Colton (1939) to refine the concept of the "Cohonina culture." The term Cohonina, as used by Hargrave, Colton, and subsequent archaeologists, referred to a distinctive archaeological assemblage from northwestern Arizona characterized by a predominance of plain gray, paddle-and-anvil pottery, pit houses, and various other traits (Hargrave 1938). The choice of this term for an archaeological culture was, in hindsight, an unfortunate one, because the word already had a well-established usage in the Hopi language as the name for the Havasupai and Hualapai (Dobyns 1974:13–16). Ever since archaeologists appropriated the name, Havasupai have insisted that they are the Cohonina, a fact that is undeniable (linguistically speaking), but that remains a topic of archaeological debate nonetheless.

Three Havasupai—Martin Clinton, Charlie Wescogomie, and Raymond Putsie—assisted McGregor with the excavations near the Grand Canyon. Schwartz became intrigued by their claims of having ancestral connections to the Cohonina culture. After entering graduate school at Yale, Schwartz pursued a Ph.D. dissertation focused on this topic. During the fall of 1953, and in the spring and summer of 1954, Schwartz conducted surveys and excavations in Havasu Canyon. His dissertation, completed the following year, described the archaeology of Havasu Canyon and presented a reconstruction of Havasupai prehistory (Schwartz 1955). Schwartz concluded that a direct link existed between the prehistoric Cohonina and historical-period "Cosninas," and that the Havasupai had lived in essentially the same area (Havasu Canyon) for at least 1,300 years. While arguing for continuity between the prehistoric Cohonina culture and the historical Havasupai, Schwartz nonetheless acknowledged the likelihood that the prehistoric Cerbat culture was ancestral to the Hualapai (Schwartz 1955:230–231).

At about the same time that Schwartz was starting his Ph.D. research, the Hualapai Tribe requested help from the MNA in documenting their aboriginal land claims. The museum director, Dr. Harold Colton, sent them a young museum staff member named Robert C. Euler to help with the land-claims research. In 1952–1955, as part of this land-claims work, Euler undertook excavations at 10 ancestral Hualapai sites in Mohawk, Peach Springs, and Meriwithica Canyons, as well as in adjoining upland areas. Euler wrote up the results of this work for his Ph.D. dissertation (Euler 1958). In contrast to Schwartz, Euler concluded that there was no continuity between the Cohonina and Pai people. Instead, Euler maintained that there had been a break in occupation between the two groups, with the Cohonina disappearing ca. A.D. 1100 or 1150, and the Cerbat culture appearing around A.D. 1250. In collaboration with anthropologist Henry Dobyns, Euler subsequently published a series of papers documenting how historical circumstances had caused the Havasupai band to become separated from the other Pai groups, with the result that they eventually acquired their own distinct tribal identity (Dobyns and Euler 1960, 1970; Euler 1975). Both the archaeological and the historical evidence led Euler to discount Schwartz's hypothesis concerning the archaeological origins of the Havasupai.

This initial disagreement between Schwartz and Euler seems to have set the stage for a lifelong professional rivalry, as they each began to concentrate their field research on the Grand Canyon. Schwartz collaborated with other scientists in documenting and publishing the first radiocarbon dates on split-twig figurines from Grand Canyon caves (Schwartz et al. 1958), and in 1959–1960, he undertook surveys in upper Shinumo and Nankoweap Creeks (Schwartz 1960, 1963).

In June 1961, Schwartz made the first attempt at an intensive archaeological survey of the river corridor within the Grand Canyon (Schwartz 1965). With helicopter support from the NPS, Schwartz and a couple of friends were dropped off at the mouth of Nankoweap Creek, along with three small rubber rafts and enough supplies to last a week. Their intention was to intensively survey the river corridor and several side canyons as far downstream as Unkar Creek. As it turned out, the logistics of getting downriver took more time than anticipated, limiting the amount of time they could devote to survey. Schwartz nevertheless managed to record 18 archaeological sites: 8 in the corridor and 10 in the upper reaches of Kwagunt and Lava-Chuar Canyons.

Meanwhile, working on behalf of the federal government in the late 1950s, Euler compiled a Southern Paiute ethnohistory and conducted limited surveys in Glen Canyon for the Indian Land Claims Commission (Euler 1964, 1966a; Sweeney and Euler 1963). Also, in the late 1950s, Euler was approached by the Arizona Power Authority and asked to conduct additional assessments of the archaeological potential of Marble Canyon and lower Grand Canyon in anticipation of the construction of Marble and Bridge Canyon Dams. In 1960, with financial support from the Arizona Power Authority, Euler took his first river trip through the Grand Canyon as part of a private river trip led by Rod Sanderson. This event apparently cemented his lifelong interest in the human history of the Grand Canyon (Euler 2001:28). He participated in two other Sanderson family river trips, traveling with them in 1963 and again in 1965, during which time he conducted additional reconnaissance surveys of areas proposed for inundation by Marble Canyon and Bridge Canyon Dams. On the 1965 trip, accompanied by Walter Taylor, he also took the opportunity to revisit and revise interpretations of many of the sites recorded by Schwartz in 1961 (Euler and Taylor 1966). On this trip, Euler also found and recorded one previously undocumented site upstream of Unkar Delta, the one now known as the "Furnace Flats" site (AZ C:13:10).

Most of Euler's work in the Grand Canyon during the early 1960s was prompted by, or directly sponsored by, the Arizona Power Authority as a result of their plans to construct dams in Marble Canyon and at Bridge Canyon. While conducting research for these power projects, Euler became intrigued by the split-twig-figurine complex in the Grand Canyon and published several popular and scientific articles on the topic (Euler 1966a, 1967b; Euler and Olson 1965). When some of these well-publicized accounts later led to vandalism in Stanton's Cave, other researchers working in the canyon accused Euler and his colleague, Henry Dobyns, of using the dam projects to further their careers at the expense of the archaeological resources (Jett 1968). These charges brought public attention to the ongoing problem of impacts from river-runner visitation and vandalism at archaeological sites in the Grand Canyon, a concern that Schwartz had raised as early as 1963 (Schwartz 1965).

Building on his previous experience, and with financial support from the National Science Foundation (NSF), in 1966, Euler hired a helicopter to fly him through the canyon in search of prehistoric sites. Euler apparently got the idea of conducting a helicopter survey after the Arizona Power Authority put one at his disposal in 1963 to assist in the archaeological inventory of Marble Canyon. Over a two-month period in the summer of 1966, Euler recorded approximately 60 sites. Most were in remote backcountry areas of the park, but a few (e.g., AZ C:13:33) were located in the Colorado River corridor.

The publicity generated by Jett's article about the ongoing vandalism in Stanton's Cave may have indirectly helped Euler secure another research grant, this time from the National Geographic Society. In June and July of 1969, with assistance from three Prescott College students and several professional colleagues, Euler conducted four weeks of excavation in Stanton's Cave (Figure 24); another week was spent at the cave in September 1970. This work uncovered an additional 58 figurines, bringing the total recovered from the site to at least 165 (Euler 1984:4). The excavations also uncovered the remains of extinct Pleistocene mammals and birds, most notably *Oreamnos* (Harrington's mountain goat) and *Teratornis* (Merriam's teratorn). At the

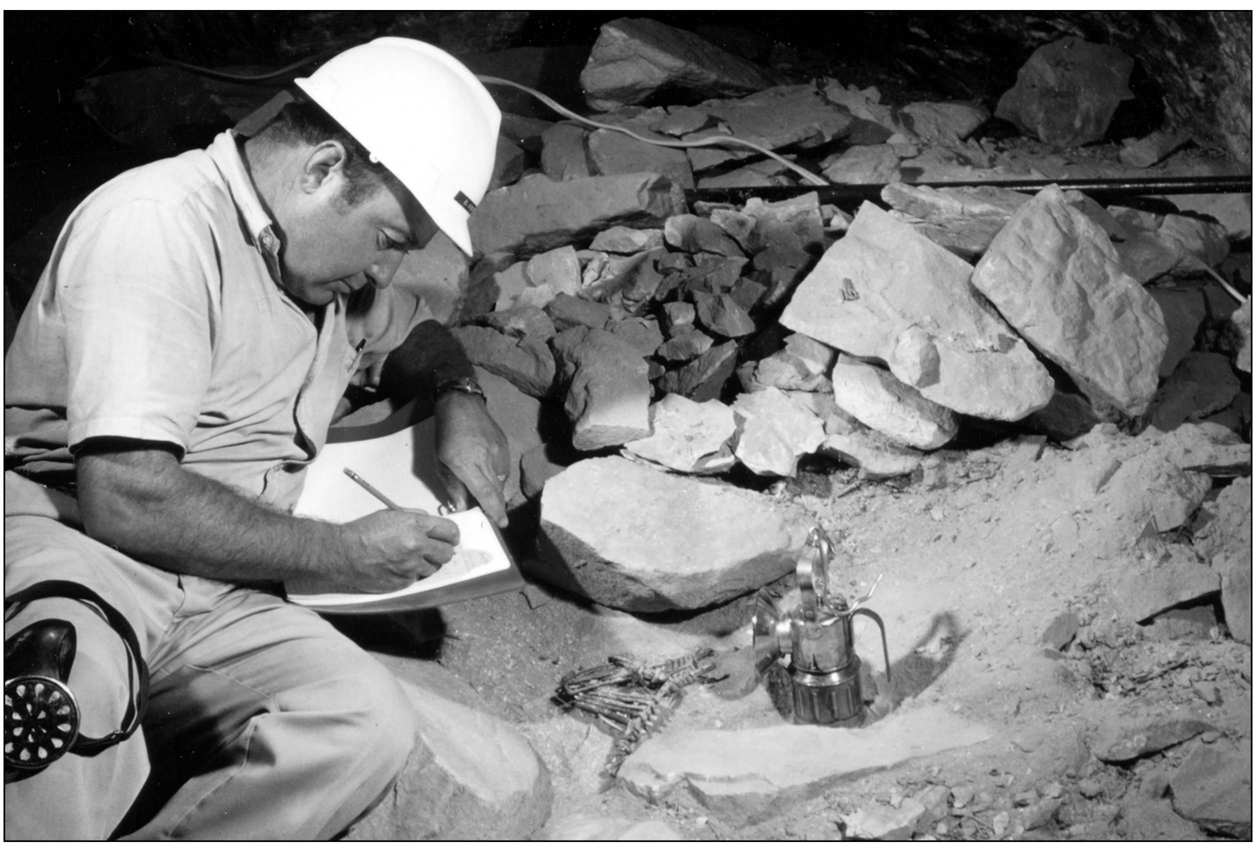

Figure 24. Robert C. Euler working in Stanton's Cave (photograph courtesy of Gloria Euler).

base of the deposits, overlying bedrock, the excavators uncovered a mass of driftwood that dated to more than 40,000 years B.P. (Euler 1984:105).

While Euler was flying over the canyon and preparing to work at Stanton's Cave, Schwartz prepared his own NSF proposal to excavate sites in the river corridor (Schwartz 1966a). Schwartz's NSF proposal was the first attempt by a Grand Canyon archaeologist to develop and test an explicit theoretical idea: that Puebloan farmers had migrated into the Grand Canyon in response to favorable climatic conditions and had subsequently adjusted their settlement strategies in response to environmental variations over the next two centuries. In his proposal to the NSF, Schwartz used examples of historical migrations from other parts of the world to develop a set of attributes that should be recognizable in the archaeological record as indicators of migration. He then proposed to test the model through excavations at Unkar Delta. Beginning in 1967 and continuing through 1969, Schwartz and a crew of students from the University of Kentucky spent summers at the bottom of the Grand Canyon excavating a series of archaeological sites (Figure 25) at Unkar Delta in 1967 and 1968 (Schwartz et al. 1980) and later at Bright Angel Ruin in 1969 (Schwartz et al. 1979). They spent most of the summer of 1969 excavating sites on the Walhalla Plateau to obtain comparative data for interpreting the inner canyon (Schwartz et al. 1981).

Schwartz's approach represents the first attempt in the Grand Canyon to answer a specific question through archaeological research: Did the Pueblo II occupation of Unkar Delta represent a migration of Puebloan farmers from outside the immediate area or an in situ development of a preexisting indigenous population? Not too surprisingly, he concluded that a migration had occurred ca. A.D. 1050. He then went on to propose that there had been a succession of occupations and temporary abandonments during the following century due to climatic fluctuations, followed by a general abandonment of the region in the early 1200s. Schwartz's work has been criticized on several grounds, but perhaps the most consistent criticism concerns his dating of the short-term abandonments (i.e., a 5-year interval between the Vishnu phase occupation, A.D. 1050–1070, and the following Zoroaster phase, A.D. 1075–1100) largely on the basis of ceramic evidence.

A major contribution of Schwartz's research was the formulation of a biseasonal settlement model involving permanent residence in the canyon bottom supplemented by summer farming on the North Rim (Schwartz et al. 1980, 1981). This model sparked a spirited debate among archaeologists that continues to the present day. A variety of settlement-subsistence models have been proposed to account for site patterning in different parts of the Grand Canyon at various times in the past (Effland et al. 1981:14–22). In addition to Schwartz's seasonal settlement model, there is the Havasupai model (summer in the canyon bottom, fall and winter in the uplands), the "Powell Plateau" model (Effland et al. 1981) (moving seasonally between small garden houses and larger pueblos within a single environmental zone), the Paiute model (residential bases in the uplands with springtime exploitation of inner-canyon resources) and most recently, Alan Sullivan's (Sullivan et al. 2002) cross-canyon model (hunting-gathering on the South Rim in the fall and winter and farming on the North Rim in the summer). As of yet, no one has attempted to define the material correlates that could be expected under each of these settlement-subsistence strategies to develop explicit hypotheses that could then be tested through a controlled program of research.

Aside from Schwartz's work, the only other archaeological projects with an explicit theoretical orientation were survey projects conducted by Euler and Chandler (1978), Effland et al. (1981), and Rice et al. (1980) in the 1970s. Euler and Chandler's work was an extension of the Southwestern Anthropological Research Group (SARG) project, which involved a consortium of southwestern archaeologists, all of whom agreed to work cooperatively to answer the basic question, "Why did people locate sites where they did?" (Plog and Hill 1971:8). Like other SARG participants, Euler and Chandler (1978) relied on an ecological model to explain site location. They attempted to answer this question by examining the association of sites with an array of environmental characteristics, including protection from the elements, and proximity to water, travel routes, and food resources (presumably wild foods, because arable lands were not considered in their analysis). They concluded that proximity to trails and water resources were the most important factors influencing site location, a conclusion since borne out by subsequent work in the river corridor. With regard to the river corridor specifically, they noted (Euler and Chandler 1978:77) that habitations along the river corridor and perennial side streams were placed high enough to be safe from floods (a conclusion that was not substantiated by the 1990–1991 corridor survey and subsequent geomorphological research) and that "[wild] food resources, with the exception of agave, seem not to have been particularly important in the selection of site location" (Euler and Chandler 1978:77). This last conclusion was also not supported by later work in the river corridor: the 1990–1991 field crew frequently commented on the absence of agave in proximity to roasting-pit sites.

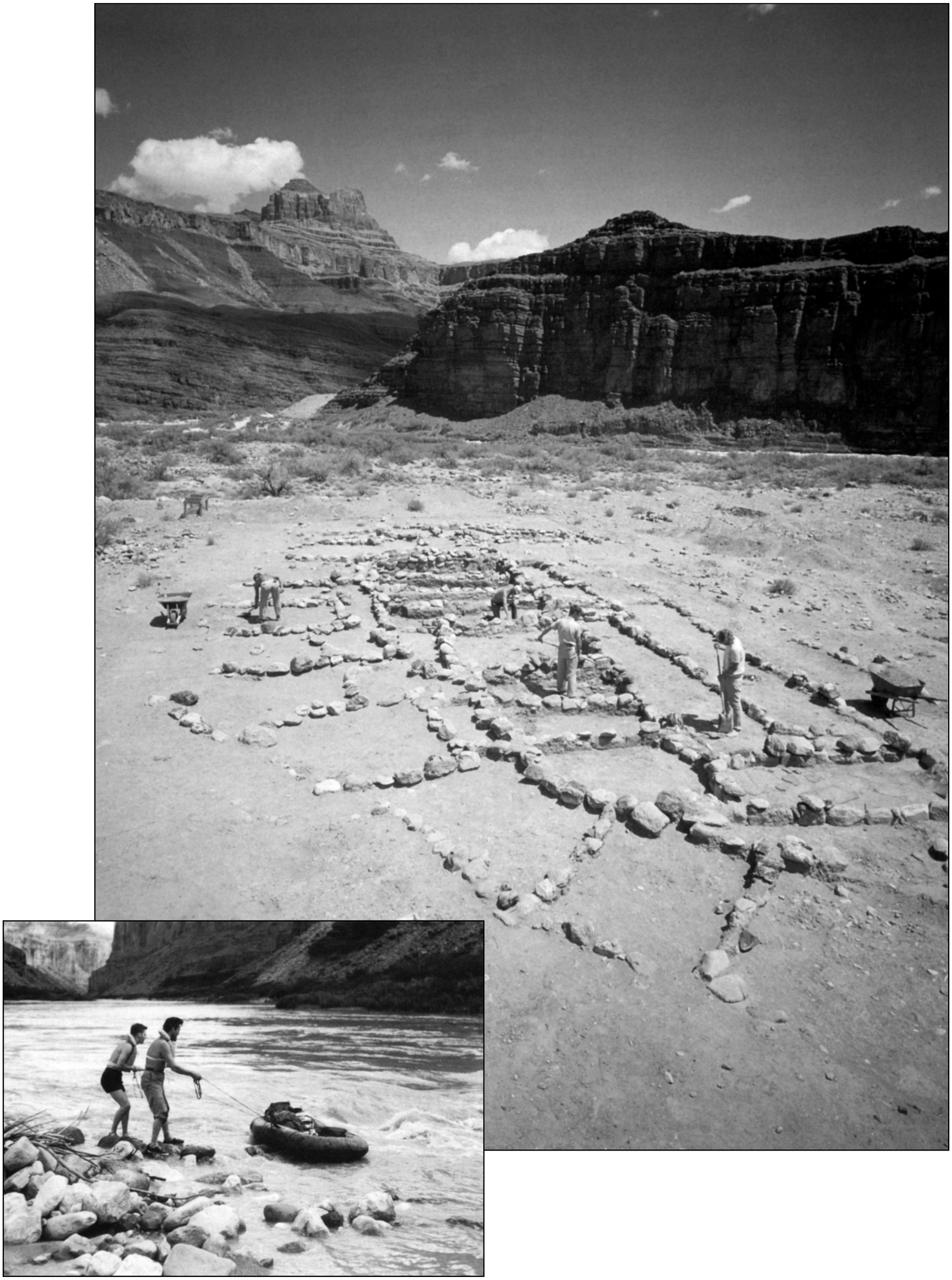

Figure 25. Excavations underway at Unkar Delta. Inset: Douglas Schwartz and Robert Wiggs negotiating a rapid in June 1961 (reprinted by permission from *The Edge of Splendor: Exploring the Grand Canyon's Human Past*, by Douglas W. Schwartz © 1990 by the School of American Research, Santa Fe).

Effland et al. (1981) explored prehistoric settlement in the Grand Canyon in terms of "adaptive responses" to the canyon environment across space and time. They discuss subsistence strategies in terms of natural-resource availability, cultivation, and the redistribution of foods through extensive social networks. As noted by Ahlstrom et al. (1993:75), the concern with redistribution reflected current trends in archaeology at the time, when the limitations of environmental models led to models that incorporated social variables to explain settlement phenomena such as aggregation and regional abandonment.

In 1974, Euler became the first staff anthropologist at Grand Canyon National Park when he was hired to serve as the park's official liaison with the neighboring Havasupai and Navajo tribes. The following year, Euler participated in a river trip organized by the park's Division of Resource Management. For several years, NPS resource managers had undertaken annual trips to monitor the condition of campsites and trails along the river. With Euler on staff, archaeological sites were added to the list of monitored resources. The next archaeological monitoring trip did not occur until 1978, but by 1982, annual Division of Resource Management river trips routinely included archaeological-site monitoring (Jan Balsom, personal communication 2002).

During the 1970s, aside from the occasional monitoring trips, little additional archaeological work was carried out along the river corridor. After writing up the results of his Grand Canyon fieldwork, Schwartz's professional interests led him in other directions, and he ceased to be active in the Grand Canyon region. Meanwhile, Euler was preoccupied with inventorying the Havasupai Traditional Use Lands within the park and surveying various proposed prescribed burn units on the North Rim (Euler 1976, 1979; Euler et al. 1980). Aspects of this "management-driven" fieldwork were subsequently analyzed and published (e.g., Effland et al. 1981; Euler and Chandler 1978; Jones 1986).

Farther to the west, Dr. Richard Thompson, of Southern Utah State College, had been conducting surveys and excavations in the vicinity of the Toroweap Valley since the late 1960s. This work continued up until 1975, when Grand Canyon National Monument became part of Grand Canyon National Park (Thompson 1970, 1971a, 1971b, 1979). The MNA also completed surveys on the Shivwits, Uinkaret, and Kanab Plateaus as part of the assessment work required prior to the enactment of the 1975 Grand Canyon Enlargement Act (Lipe and Thompson 1978, 1979; Moffitt and Chang 1978). These surveys and excavations revealed an extensive occupation of the plateaus north of the Colorado River by Puebloan farmers associated with the Virgin branch of the Anasazi dating between ca. A.D. 200 through the late 1100s, as well as by Southern Paiute hunter-gatherers beginning sometime after A.D. 1200.

Beginning in 1974, Euler sought funding from the NPS to conduct test excavations at several stratified rockshelter sites within the inner canyon (Jones 1986:1). The proposed purpose of these test excavations was to refine understanding about the timing and extent of the various cultural occupations within the canyon (Euler 1974:142–147). Failing to secure funding after multiple attempts, Euler and his assistant, Trinkle Jones, tried a new approach: they tied the funding request to NPS-management requirements, specifically the need to mitigate impacts from river-running visitors and natural erosion at these sites (Trinkle Jones, personal communication 2001). Finally in 1984, shortly before Euler left his position at Grand Canyon National Park, the NPS provided funding to test and stabilize five stratified rockshelters (Jones 1986). Although limited to profiling eroded portions of the middens prior to installing retaining walls, this project involved the first and most carefully controlled excavations to be conducted in the river corridor since Euler's work at Stanton's Cave 15 years before.

The 1984 work, supervised by NPS archaeologist Trinkle Jones, focused on three stratified rockshelter sites within the river corridor and one located several miles away from the river, in Tuna Creek. A fifth rockshelter that had been targeted for testing was found to be located on the Hualapai Reservation; instead, a Puebloan site upstream of Unkar Delta, AZ C:13:10, which had recently suffered severe erosion, was substituted at the last minute (Figure 26) (Jones 1986:1).

One key result of the 1984 excavation project was to demonstrate that visible surface remains were extremely poor predictors of the complexity and depth of cultural deposits at each of the studied locations. Three of the four shelter sites revealed preceramic occupations that were undetectable from surface evidence. At AZ A:16:1, near Whitmore Wash (Figure 27), surface midden material dating to the protohistoric Paiute occupation concealed strata containing Virgin Anasazi ceramics dating to around A.D. 1000. Below that level, a roasting pit associated with a San Pedro (or Elko?) Side-notched point produced a 2-sigma calibrated radiocarbon date of 1365–905 B.C. (Jones 1986:105). At AZ B:10:4 near Deer Creek, a late Pueblo II period structure concealed an aceramic deposit with a roasting pit that radiocarbon-dated between cal A.D. 425 and 85 cal B.C. (Jones 1986:105). At a third site near the mouth of the Little Colorado River, the archaeologists found that the historical-period Beamer's cabin sat on top of a midden dating to the Pueblo II era, which in turn overlay earlier ceramic

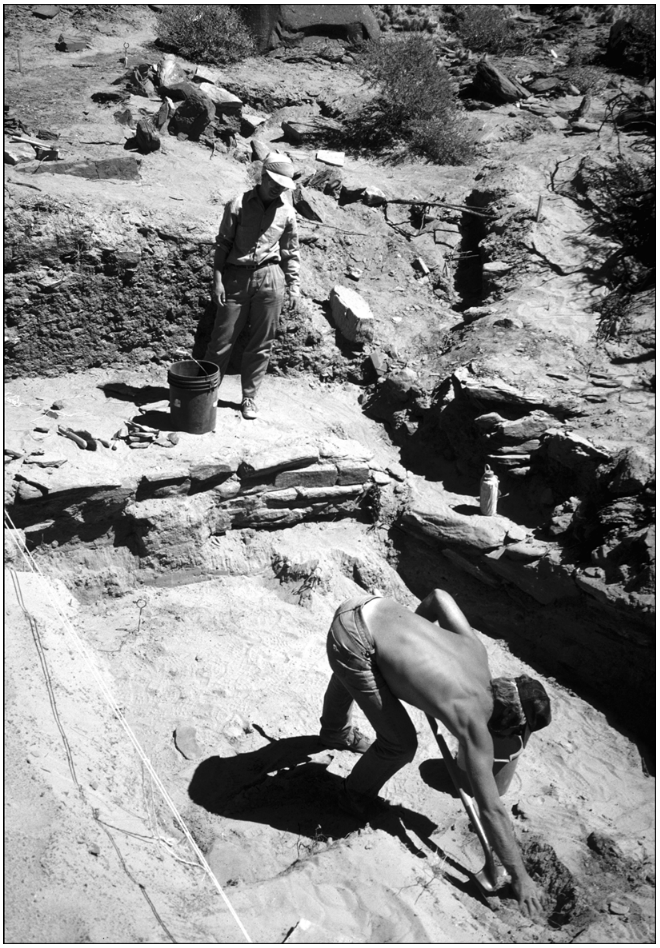

Figure 26. 1984 excavations underway at the Furnace Flats site, AZ C:13:10 (photograph by Helen Fairley).

deposits and an aceramic level that dated between cal A.D. 440 and 795 (Jones 1986:105). The excavations at AZ C:13:10 revealed buried structures that dated primarily to the late Pueblo II–early Pueblo III period, which had intact masonry walls measuring up to 1.6 m high (Figure 28). One buried room contained abundant quantities of ground stone and evidence of a travertine-pendant workshop. Although no preceramic levels were encountered, Jones suspected that an earlier Pueblo I occupation might be present at the site, based on the presence of a few diagnostic Pueblo I pottery types (Jones 1986:79). Later work at the site, conducted in conjunction with geomorphic studies (Hereford et al. 1991), revealed a Pueblo I level dominated by San Francisco Mountain Gray Ware ceramics deeply buried beneath the Pueblo II structures in the downstream (western) portion of the site.

Throughout the 1980s, annual monitoring of archaeological sites located along the Colorado River in Grand Canyon National Park continued (Figure 29). The monitoring program in the river corridor at this time was relatively informal. From a list of approximately 140 sites (including many located in side canyons), a sample would be selected for monitoring each year. Initially, sites were judgmentally selected for monitoring each year, but after 1984, sites were assigned to a specific monitoring cycle based on a more-or-less subjective assessment of relative threats from visitor use and natural agents of erosion. Certain sites that were well known among river runners were monitored every year, while others were monitored every two to three years, or less frequently. During the monitoring trips, archaeologists compared current site conditions with photographs taken on previous trips, and photographs were replicated. When new damage was observed, archaeologists took notes on copies of the site form or on a separate sheet of paper. The notes typically included references to new artifact piles, new evidence of erosion, or damage to structures that would require future stabilization, but there was neither a set format nor any attempt to systematically quantify the degree of change from one year to the next. The monitoring results were summarized in short reports following each trip, and these trip reports typically included recommendations for future mitigation of impacts. Some of the observed impacts would be mitigated on subsequent trips by rerouting trails or conducting stabilization repairs, but the continuing loss of site

Figure 27. Exposed midden profile at AZ A:16:1, shortly before stabilization (photograph by Helen Fairley).

integrity caused by erosion was not addressed in a systematic way.

Meanwhile, in Glen Canyon National Recreation Area, additional archaeological inventory was undertaken in and around the river corridor below Glen Canyon Dam in the 1980s. In 1980, as part of GCES Phase I (GCES-I), a survey of the river corridor between Glen Canyon Dam and Lees Ferry was completed by NPS Regional Archaeologist Adrienne Anderson and Reclamation archaeologist Lou Madden, resulting in the documentation of 12 archaeological sites, 24 isolated finds, and "two historic complexes"; however, a report on this work was never completed. Subsequently, in late 1983 and early 1984, NPS volunteer Greer Chesher recorded 25 sites and 8 other "cultural features" in the vicinity of Lees Ferry. This work was likewise never summarized in a formal report. In the fall of 1984, NAU completed an intensive inventory of approximately 1,100 acres in the Lees Ferry area, part of which overlapped with Chesher's inventory area, but only a small portion of which involved the river corridor (Geib 1986). The following year, Nickens and Associates, a cultural resource management (CRM) contracting firm, completed detailed documentation and

Figure 28. Partially excavated structure at AZ C:13:10 (photograph by Helen Fairley).

Figure 29. National Park Service archaeologist Jan Balsom monitoring AZ C:13:9, September 1984 (photograph by Helen Fairley).

stabilization of historic features associated with the Main Ferry site (Einiger and Horn 1987), and in 1986, the Submerged Cultural Resources Branch of the NPS, Santa Fe Office, completed detailed documentation of the sunken Spencer Steamboat and associated historical remains related to the Spencer mining operation at Lees Ferry (Carrell et al. 1987).

In 1986, Glen Canyon National Recreation Area archaeologists implemented a monitoring program for the Glen Canyon sites located downstream of the dam. In the course of revisiting these sites, earlier documentation was substantially upgraded and refined. However, the archaeologists performing the monitoring also discovered numerous inconsistencies in the previous recording methods, as well as duplicate records and site numbers. To rectify these problems, the following year, the NPS amended its contract with NAU to include the preparation of a synthetic report to "organize, evaluate, and summarize the existing archaeological data base for the Glen Canyon National Recreation Area below the Glen Canyon Dam" (Geib 1990:1).

The annual monitoring trips, several minor reconnaissance surveys, and Jones's 1984 excavation project constituted the bulk of archaeological fieldwork carried out within the river corridor during the 1980s. During this decade, most archaeological efforts within Grand Canyon National Park concentrated on the South Rim, where compliance surveys and excavations were conducted in advance of road and pipeline developments. In 1984, NPS archaeologists surveyed a proposed waterline between Desert View and Tusayan Pueblo and encountered a previously unknown ruin equivalent in age and size to the Tusayan site; several sites along the pipeline route were subsequently excavated (Balsom 1986). In 1989, an intensive inventory of the South Rim between Grandview Point and Lipan Point, conducted in advance of widening East Rim Drive, revealed a pattern of site distributions very similar to that noted by Euler on the North Rim (Euler and Chandler 1978), characterized by Puebloan structures that tended to be concentrated around the routes leading in and out of the inner canyon (Fairley 1990).

Meanwhile, in 1983, east of the park boundary, archaeologists from the Arizona State Museum surveyed a portion of the Highway 64 corridor between Desert View and Cameron, and, in 1984, four sites within the right-of-way were excavated (Sullivan 1986). Alan Sullivan, the project director, became intrigued by the results of these excavations, particularly the paucity of evidence for cultivated crops in sites that otherwise appeared to be rather typical Kayenta Anasazi habitations and field houses. He proposed that the Anasazi occupants of the Upper Basin primarily depended on pinyon nuts and other wild foods, and that their subsistence regimen differed markedly from that of contemporaneous Anasazi living within the canyon and on the North Rim (Sullivan 1987). The implications of these ideas prompted Sullivan to initiate the Upper Basin Archaeological Research Project, a multiyear survey and excavation effort that is continuing up to the present day (Sullivan et al. 2002).

Between August 1990 and April 1991, an intensive archaeological inventory of the river corridor from the base of Glen Canyon Dam to Separation Canyon was completed to comply with the requirements of an ongoing Environmental Impact Study to assess the effects of the operation of Glen Canyon Dam on downstream resources (Fairley et al. 1994). The survey was compliance driven and was not preceded by the preparation of an in-depth research design. Rather, it was specifically focused on documenting the age, extent, type, artifactual associations, and specific locations of archaeological sites within the river corridor located within the zone of potential effect from operations of Glen Canyon Dam (Figure 30). The focus was on the area located below the approximate 300,000-cfs flow level of the river, which at the time was considered to be the maximum historical-period flood level of the river (cf. Topping et al. 2003). Because the location of the 300,000-cfs flow level was not precisely known, the survey focused on all Holocene deposits. Where mesquites were present, the upper level of these vegetation bands served as a proxy for the survey boundary area; in other areas, driftwood and terrace geomorphology served as markers. A total of 475 archaeological sites was documented during the inventory (Fairley et al. 1994), including 60 sites in the Glen Canyon portion of the river corridor (Clark 1991:5). The results of the survey did not significantly alter previous conclusions about prehistoric and historical-period use of the river corridor, although they did contribute new evidence concerning the depth and spatial extent of preceramic and protohistoric occupation in the corridor. Furthermore, the survey disproved Euler and Chandler's (1978) contention that prehistoric people did not live within the river's flood zone. Perhaps most significantly, the survey quadrupled the number of recorded sites in the river corridor.

As the following section of this chapter discusses in more detail, USGS geologists Richard Hereford and Ivo Lucchitta conducted geoarchaeological studies in the river corridor concurrent with, and for four years subsequent to, the archaeological inventory survey. The management rationale for funding this work was to assess the sedimentological and geomorphic contexts of sites in the river corridor in order to evaluate current and future threats from erosion (Balsom et al. 1989). The results of these studies also provided valuable new information relevant to several cultural research issues. Specifically, the geoarchaeological studies demonstrated that human occupation of the river corridor was more continuous and the story of landscape evolution more complex than survey results indicated. Radiocarbon dates obtained from buried alluvial and aeolian contexts indicated that the river corridor has undergone repeated cycles of aggradation and erosion over the past 5,000 years. Buried within the Holocene terraces, upon which many Pueblo II sites were located, were other sites with Cohonina pottery dating to the Pueblo I era (ca. A.D. 800–1000), as well as preceramic sites dating to the Basketmaker II and late/terminal Archaic periods.

After the completion of the survey in 1991, Grand Canyon National Park and Glen Canyon National Recreation Area revised their monitoring program and implemented an ongoing remedial action program (Leap et al. 2000). The current monitoring program relies on repeat photography and standardized forms to track changes in erosion status and document visitor impacts at archaeological sites (Figure 31). Repeat topographic mapping of selected sites, which would monitor changes in surface morphology and quantify the volume of sediment loss, was initiated in 1995 but subsequently discon-

Figure 30. National Park Service archaeologist Peter Bungart recording AZ C:9:69 during the 1990–1991 inventory project (photograph by Helen Fairley).

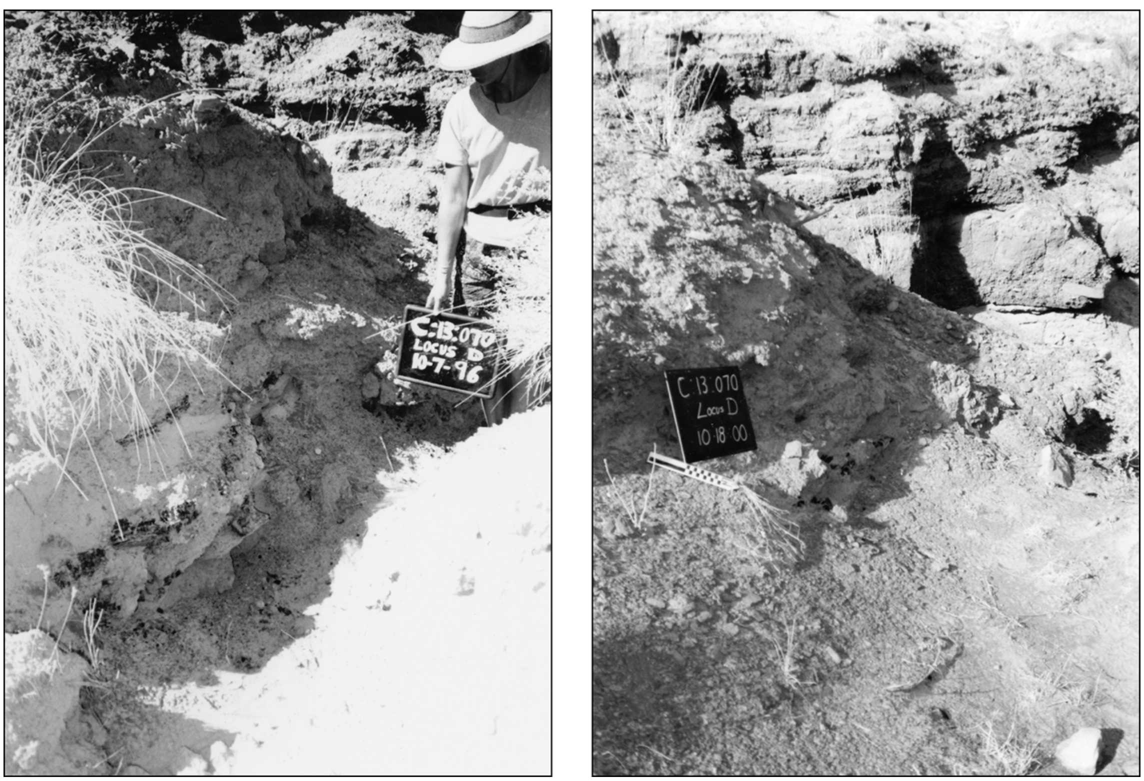

Figure 31. National Park Service volunteer Kate Thompson monitoring site AZ C:13:70. Note that charred beams exposed in bank in photo on the left (taken in 1996) have been removed by bank slumpage and erosion in photo on the right (taken in 2000) (courtesy of Grand Canyon National Park Archaeology Program).

tinued. Sixty-eight sites in the Grand Canyon river corridor and 10 sites in the Glen Canyon reach were mapped with total stations between 1995 and 1998 (Neal et al. 2000:116). Eleven of the Grand Canyon sites were remapped before Reclamation discontinued funding of the mapping program in 1999. It is interesting to note that preliminary results of the topographic mapping effort indicated that 9 of 11 remapped sites evidenced increases in net sediment deposition (Leap et al. 2000:1–26), even though the monitoring forms for several of these same sites indicated there had been "geomorphic activity" indicative of site degradation (Leap et al. 2000:1–24).

Monitoring protocols have undergone several revisions since the initial survey was completed. During the survey, condition information was recorded on open-ended forms that requested information on current visible impacts and probable threats. Terminology and the types of information requested were not explicitly defined, and, as a result, the quantity and quality of recorded information varied considerably. During the first two years of monitoring following the completion of the survey, information about the condition of the sites was recorded on a multipage form that had been adapted from one used in Grand Canyon backcountry monitoring. This approach attempted to assess the amount of area being impacted and then rank the intensity and the types of impacts with the purpose of approximating an objective assessment of site condition and monitoring priority. In 1993, this approach was abandoned in favor of a much more streamlined one. Initially, the new approach documented whether erosion and visitation impacts had increased, decreased, or remained the same since the last visit; it also noted whether erosion and visitation were affecting structures, features, artifacts, or other aspects of the site. These observations were supported by numerous repeat photographs. The monitoring system was further refined and streamlined in the mid-1990s. The current monitoring format records whether erosion and visitor-related impacts are active, inactive, or not applicable in relation to various site attributes (Figure 32).

The number of sites being monitored on an annual basis has changed over the years as a result of scientific, pragmatic, and philosophical shifts in the program. Initially, 336 sites in Glen Canyon and the Grand Canyon were thought to be potentially affected by operations of Glen Canyon Dam. Two additional sites were added to this list between 1991 and 1999, but 24 were subsequently removed, resulting in a total of 318 monitored sites—54 in Glen Canyon (including Navajo Nation land) and 264 in the Grand Canyon (including Hualapai Tribe land) (Leap et al. 2000:1–8). In 2000, the Navajo Nation assumed responsibility for managing the archaeological sites located on tribal trust land upstream of the Paria River and subsequently discontinued monitoring activities at 21 sites. Downstream in Grand Canyon National Park, approximately 87 sites have been placed on an "inactive" list and are no longer being monitored (Leap et al. 2000:xiii).

The current monitoring program is primarily designed to track whether site conditions are improving, deteriorating, or stable, using low-tech, cost-effective methods and objective criteria. The program is not designed to track long-term trends or changes in rates of impacts, nor is it capable of generating data that could be used to test specific hypotheses or demonstrate connections between specific geomorphic processes (e.g., side-canyon floods, dam operations, rainfall) and ongoing erosion. The one exception to this general rule is the use of stationary cameras at two archaeological sites in Glen Canyon and near four sites in the Grand Canyon that document potential changes in the shape of river-cut banks on a daily basis; however, the data from this program have not yet been compiled or analyzed, so the long-term utility of this approach remains uncertain. Because the main focus of the current monitoring program is to determine whether or not impacts are occurring rather than to demonstrate links between observed impacts and specific processes or causal agents, the monitoring program has had limited applicability for demonstrating a clear connection between current operations of Glen Canyon Dam and ongoing impacts to cultural resources in the river corridor (Doelle 2000:24). Also, as pointed out by Leap et al. (2000:1–24), the current monitoring form is not capable of showing whether or not physical deterioration of sites is occurring, only whether or not geomorphic activity of one kind or another is evident. Grand Canyon archaeologists are currently trying to address these deficiencies by incorporating variables from Thompson and Potochnik's (2000) erosion model into the monitoring program (Leap et al. 2000) and by measuring arroyo cross sections at selected sites (Dierker et al. 2002).

Grand Canyon archaeologists use the results of the monitoring program to determine where to focus future preservation actions and data-recovery efforts. Remedial actions undertaken at archaeological sites during the past decade have ranged from installing checkdams (Figure 33) and obliterating trails to mapping sites and conducting excavations. As of the year 2000, 96 archaeological sites were subject to some kind of remedial action (Leap et al. 2000:1–16). The term "data recovery," as currently used in the Grand Canyon archaeological program, refers to a wide range of activities, including total-station mapping, random-unit testing, the collection

3/00 **Grand Canyon National Park and Glen Canyon National Recreation Area**

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

MANAGEMENT

1. Site Number AZ ________ 2. Monitor Session ________
3. River Mile ____ Bank (L/R/B) ____ 4. Date ________
5. Property Type: ________
6. Monitor(s) ________
7. PA Signatories ________

PHYSICAL IMPACTS

Coding: 0 = Absent, 1 = Active, 2 = Inactive, 3 = NA (for items 8 - 14)

		Structures / Storage	Artifacts	Roasters / Hearths	Perishable / Midden	Rock Images	Other
8.	Surface Erosion (0 - 10 cm)						
9.	Gullying (10 - 100 cm)						
10.	Arroyo Cuttin (> 1 m)						
11.	Bank Slump						
12.	Eolian/Alluvial Erosion/Deposition						
13.	Side Canyon Erosion						
14.	Other Physical Impacts (animals spalling, roots)						

15. Drainage Type (river, terrace, or side canyon-based or no drainages): ____
16. Do any of the above impacts appear to have occurred since the last monitoring episode
 0 = No, 1 = Yes. If yes, explain in Question # 17. ____
17. Comments:

3/00 **Grand Canyon National Park and Glen Canyon National Recreation Area**

RIVER CORRIDOR ARCHAEOLOGICAL SITE MONITORING FORM

VISITOR-RELATED IMPACTS

Site Number: C:02:070

Monitor Session:

Coding: 0 = Absent, 1 = Present, 3 = NA (for items 18 - 24

		Structures / Storage	Artifacts	Roasters / Hearths	Perishables / Midden	Rock Images	Other
18.	Visitor Impacts						

19. Collection Piles: If present, explain in Question # 2 ____
20. Trails On-Site: If present, explain in Question # 26. Explain any off-site trails als ____
21. Camping On-Site: If present, explain in Question # 26 ____
22. Criminal vandalism/ARPA violations: If present, explain in Question # 2 ____
23. Other visitor impacts: If present, explain in Question # 2 ____
24. Visitor-related impacts since last monitoring: ____
25. Are any visitor-related impacts directly related to river fluctuations and/or dam operations, i
 development of new trails to avoid high water, availability of new beaches in proximity of sit
 0 = No, 1 = Yes. If yes, explain in Question # 26 ____
26. Comments:

RECOMMENDATIONS

27. Monitor Schedule: 1) Discontinue 2) Semiannual 3) Annual 4) Biennial
 5) Every three to five years 6) Inactive 7) Control Group ____
28. Preservation Options: 0 = No, 1 = Yes
 Trail Work ____ Plant vegetation ____ Other Preservation Options ____
 Install checkdams ____
29. Recovery Options: 0 = No, 1 = Yes
 Research ____ Data Recovery ____ Other Recovery Options ____
30. Comments:

Figure 32. The current Grand Canyon River Corridor Archaeological Site Monitoring Form.

Figure 33. Soil conservation specialists from the Pueblo of Zuni installing erosion-control checkdams at site AZ C:13:381 (courtesy of Grand Canyon National Park Archaeology Program).

of surface artifacts, the excavation of single features, and the extraction of carbon samples from arroyo walls (Nancy Andrews, personal communication 2002). Grand Canyon records indicate that data-recovery excavations (the term, as used in the Grand Canyon archaeological program, includes testing, extraction of individual radiocarbon dates, and/or excavation of one or more individual features) have been undertaken at 42 sites in the Grand Canyon portion of the river corridor (Leap et al. 2000:xiv) and 6 sites in the Glen Canyon portion (Neal et al. 2000:153; Neff and Core 2001; Neff and Wilson 2002; Wilson and Neff 2002). To date, no sites have been excavated to a level that most archaeologists would consider "full data recovery" (Figure 34).

Currently, features are selected for excavation purely on the basis of their presumed susceptibility to erosion. The goal of feature-based excavation is to salvage information before it is lost. The rationale for focusing on individual features, rather than whole sites, is motivated by a desire to preserve as much of the resource as possible in context (Leap et al. 2000). As Yeatts (1998:30) observes, this salvage-oriented approach to data recovery has serious limitations from a research standpoint:

> Excavations in the Grand Canyon as a method to mitigate erosion due to dam operations must be viewed with long-term research goals in mind. Rarely will those features that can best address specific research topics be the ones that are available for study; erosion does not often select locations based on research agendas. Similarly, those areas available for study by definition will not be the pristine deposits. They will be those that are being impacted by erosion. Therefore, achieving answers to specific research topics may be a long process slowly realized through incremental gains.

At this point in time, in 2003, it is difficult to draw any firm conclusions about the long-term value of the feature-based data-recovery approach, because of the relatively small number of features that have been excavated so far, and because some of the data-recovery results are not yet available. Currently, final reports have been produced on feature-based excavations conducted at six sites in 1997: AZ A:15:030, AZ A:16:180, AZ C:13:273, AZ C:13:338, AZ C:13:359, and AZ C:09:51 (Yeatts 1998, 2000), and two of five sites tested in 1999: AZ A:15:48 and AZ G:03:20 (Dierker and Downum 2002). Also, a

Figure 34. Archaeologists from the National Park Service, Hopi Tribe, and Western Area Power Authority excavating at AZ C:13:10 in 1998 (courtesy of Grand Canyon National Park Archaeology Program).

report is available on feature-based testing that was conducted at four sites in 1996 in anticipation of the April 1996 experimental Beach Habitat Building Flow: AZ C:13:10, AZ C:13:321, AZ C:13:365, and AZ C:13:371 (Balsom and Larralde 1996). Results of feature-based excavations and other forms of subsurface testing performed in 1999 at AZ C:02:96, AZ C:09:69, AZ C:13:10, AZ C:13:99, AZ C:13:347, AZ C:13:349, and AZ G:03:64 are not yet available (Kunde 1999).

Most of the feature-based excavation projects reported to date have focused on salvaging eroding roasting pits or hearths. As is typical of thermally altered features, feature contents have produced relatively few identifiable pollen grains (Smith 1998), and, with the exception of the wood charcoal, few identifiable macrobotanical remains have been recovered (e.g., Dierker and Downum 2002; Matthews 1998; Yeatts 2000). The charcoal is typically either mesquite, pine (presumably from driftwood), or some combination of these species. It is possible that over time some patterning in charcoal preferences may become apparent, but as of yet, no cultural or temporal patterning in wood utilization is discernible. Perhaps the greatest contribution of the feature-based excavations has been to reveal the variability and the degree of formalization in subsurface roasting-pit morphology (Yeatts 1998:29).

Many of the excavated features have produced radiocarbon dates (Dierker and Downum 2002; Yeatts 1998). These dates have been derived almost exclusively from wood charcoal. Several of the dates have not conformed to the archaeologists' original expectations of feature age, being either considerably older or younger than anticipated (e.g., Dierker and Downum 2002:22–24; Yeatts 1998:28). Owing to the absence of an overall understanding of site-formation processes and a paucity of duplicate dates derived from single features, it is difficult to interpret these radiocarbon results. Despite the fact that most of the radiocarbon dates were derived from wood charcoal, which may be several centuries older than the targeted event, there has been a tendency on the part of some researchers to interpret the dates at face value (e.g., Balsom and Larralde 1996:100; Dierker and Downum 2002:35). Given these concerns, reviewers of the GCMRC cultural program have suggested that alternatives to radiocarbon dating for addressing chronometric issues at sites in the river corridor need to be explored in the future (Doelle 2000:24).

History of Geomorphological Research in the Colorado River Corridor

From the standpoint of geology, the Grand Canyon is one of the most intensively studied terrains in the world. Yet surprisingly little attention has been paid to the most recent part of the Grand Canyon's geologic story. Prior to the mid-1970s, the number of studies related to either the Pleistocene or Holocene deposits in the Grand Canyon could be counted on two hands. Most of these studies focused on landslides (Ford and Breed 1970; Ford et al. 1974; Huntoon 1975; McKee 1933; Péwé 1968) rather than on the sedimentary deposits created and left by the Colorado River. One noteworthy exception was McKee's (1938) study of sedimentary structures in Colorado River flood deposits. Upstream, in Glen Canyon, no studies of the terraces and associated fluvial deposits along the Colorado River were undertaken prior to the inundation by Lake Powell. In fact, the only geomorphological research conducted in association with the Glen Canyon project was a study by Lance (1963) of the deep alluvium in Moqui and Lake Canyons.

In the mid-1970s, as a result of growing environmental concerns over the possible effects of Glen Canyon Dam on downstream resources, studies increasingly focused on the fluvial deposits within the Grand Canyon river corridor (Howard 1975; Howard and Dolan 1976, 1979). Up until the late 1980s, however, virtually all river-corridor sediment studies focused on the rapids, debris flows, and post-dam-era sand deposits ("beaches") in or immediately adjacent to the river channel (Howard and Dolan 1981; Kieffer 1985; Schmidt 1990; Schmidt and Graf 1988; Webb et al. 1987). The only research effort that deviated from this general pattern was a geomorphological reconnaissance study unrelated to the GCES, which was conducted in conjunction with Jones's 1984 archaeological excavations (Karlstrom 1986).

Karlstrom looked specifically at the geomorphological setting of archaeological sites in relation to the river and side streams. He found general correlations between the apparent ages of Colorado River terrace deposits and those documented elsewhere in northern Arizona (e.g., Karlstrom 1988). At the Furnace Flats site (AZ C:13:10), Karlstrom (1986:33) noted the presence of human-made structures buried under mixed fluvial, colluvial, and aeolian sediments and speculated that flooding may have driven the prehistoric inhabitants out of the area. Unfortunately, Karlstrom's time in the field was limited to less than a week and was divided among five widely scattered locations bounded by the Little Colorado River and Whitmore Wash, so his study was superficial and his conclusions limited in scope. Nevertheless, he observed that a great deal of valuable information about the pre-dam river system, climate change, and their effects upon the prehistoric inhabitants of the river corridor could be gleaned from further, in-depth studies of these deposits (Karlstrom 1986:25–26). Furthermore, he noted that because the post-dam river "is underloaded and compensates by scouring the channel bed and the terraces and fans which line the river [u]nder this [post-Dam] fluvial regime, sites located along the river should be considered as ephemeral as the surfaces on which they occur" (Karlstrom 1986:34).

As questions continued to arise about the possible effects of dam operations on archaeological resources, Reclamation's GCES program widened its scope of inquiry to include older alluvial and aeolian deposits located throughout the river corridor. Between 1989 and 1996, GCES-II funded a series of studies to assess the effects of the operation of Glen Canyon Dam on downstream archaeological resources. Two USGS geologists, Richard Hereford and Ivo Lucchitta, headed up studies on Holocene and Pleistocene geomorphology, respectively. Hereford's work dealt exclusively with the Holocene-age sedimentary deposits, and Lucchitta examined the Quaternary setting as a whole. Both researchers examined the effects of long-term fluvial, colluvial, and aeolian processes on archaeological sites situated on and in the Quaternary terraces bordering the river. The ultimate aim of the geomorphological research was to develop a model of site-erosion susceptibility (Balsom et al. 1989). In the process, a great deal of information surfaced about the archaeological sites, the setting in which they are located, and the physical processes that acted upon them over time. These studies have important implications for future planning and the management of archaeological resources in the river corridor (Thompson and Bettis 1982).

Lucchitta's work broadly encompassed the Quaternary geomorphology of the river corridor. Using standard geomorphological mapping techniques, soils analysis, and experimental techniques such as 10Be and 26Al cosmogenic radionuclide dating methods, Lucchitta identified and established relative ages for five prominent terraces and associated suites of riverine sand and gravel in the eastern Grand Canyon. He attributed the terraces to five major cycles of down-cutting and aggradation over the past 1.6 million years (Lucchitta 1991). From oldest to youngest, and in order of descending elevation, he named them the Basalt Cliffs, Escalante, Tanner, Ocha Point, and Cardenas Suites (Lucchitta 1991:25). The youngest terrace level, the "Cardenas Suite," consisted of fine-grained sediment interspersed with colluvial slope wash and represented the Holocene time period. It corresponded to the area mapped in detail by Hereford (1996); Hereford, Thompson, Burke, and Fairley (1996); and Hereford et al. (1993, 1995). In the western Grand Canyon, in the Granite Park area, Lucchitta et al. (1995) identified four prominent terraces, only one of which (the "Archeologic Unit") clearly correlated with any of the terrace suites identified in the eastern Grand Canyon (the Cardenas Suite). The difference between these two areas was attributed to the effects of Quaternary vulcanism in the western Grand Canyon (Lucchitta et al. 1995:39; cf. Fenton et al. 2001, 2002).

From his geomorphological analysis, Lucchitta (1991:4) concluded that throughout the past 1.6 million years, the overall Regimen of the Colorado River was dominated by down-cutting, but that periodically this regimen had been interrupted by intervals of backfilling. Lucchitta speculated that the down-cutting–backfilling cycles were related to climate fluctuations. He believed that cooler, wetter climatic conditions had the effect of overloading the river with sediment, causing it zto aggrade; whereas warmer, drier climatic conditions decreased the sediment supply to the river and resulted in down-cutting (Lucchitta 1991:4). Lucchitta speculated that most aggradational episodes during the Quaternary were related to overloading of the system by glacial runoff. However, he noted that the latest Holocene deposits in the river corridor could not be a product of glacial runoff, as they were too young. Instead, he attributed the youngest fluvial deposits to temporary overloading of the river system caused by the erosion of regionally developed Pinedale-age alluvial and colluvial aprons. Lucchitta made no attempt to test his hypotheses, however, and the mechanisms by which cool-moist climates resulted in sediment loading were never discussed in detail, so his hypothesized correlations between Quaternary climate cycles and the sediment packages in the river corridor remain untested.

From the standpoint of archaeological-site preservation, perhaps the most valuable contribution of Lucchitta's GCES-funded research was his recognition of the important role of aeolian processes in preserving and protecting archaeological sites situated on the Holocene terraces from the damaging effects of erosion (Lucchitta 1992:3–4; Lucchitta et al. 1995:8). Lucchitta (1991:14) argued that wind had been a dominant force in shaping river-corridor deposits throughout the Quaternary. He speculated that the wind factor may have contributed to the loss of arable land in the river corridor during the early 1200s, when down-cutting of the main channel resulted in lowered water tables, which in turn destabilized the sandy terrace deposits and led to their active entrainment by aeolian processes (Lucchitta 1992:3–4; Lucchitta et al. 1995:7–8). Lucchitta suggested that the extensive dunes that formed during this period would have helped to stabilize abandoned structures and thus protect them from erosion, because dunes are highly effective at absorbing water, thereby minimizing runoff. Furthermore, he noted that dunes have the capacity to rapidly self-seal gullies that may form during exceptionally concentrated runoff events, provided that the sand supply is constant. Lucchitta (1992:4) argued that because of the sand supply is now drastically reduced because of the presence of the dam, the lack of annual sediment-laden floods, and the increase in riparian vegetation in the absence of scouring events, the fine sand suitable for entrainment by the wind is no longer abundantly available. The net effect is that sand sheets and dunes have become increasingly vulnerable to erosion by concentrated runoff events. Lucchitta (1992:4) suggested that the one scenario that might improve the current situation would be to release maximum discharges at frequent intervals from Glen Canyon Dam, thereby increasing the available sand supply, clearing vegetation, and restocking the sandbars and beaches with sand that would then be available for redeposition at higher elevations via aeolian-transport mechanisms.

Unlike Lucchitta, Hereford's geomorphological research was concerned exclusively with the Holocene sediments in the river corridor. More specifically, it focused on documenting the depositional contexts of archaeological sites and the potential role of dam operations in influencing the current patterns and processes of erosion. His research centered on four main areas in the Grand Canyon, each containing extensive alluvial deposits and a relatively high density of archaeological sites: Lees Ferry at River Mile 0 (Hereford et al. 2000b), the Nankoweap area between River Miles 52 and 53 (Hereford, Thompson, and Burke 1998), the Palisades–Unkar Creek reach (locally known as "Furnace Flats") between Miles 65 and 70 (Hereford 1996; Hereford, Thompson, Burke, and Fairley 1996; Hereford et al. 1991, 1993, 1995, 1997), and the Granite Park area between Miles 207 and 209 (Hereford 1996; Hereford, Thompson, Burke, and Fairley 1996; Hereford et al. 2000a) (Figure 35). An interdisciplinary core team composed of a geomorphologist, a soil scientist, a bedrock/structural geologist, and an archaeologist carried out the field studies (Figure 36).

Hereford's research relied on several different lines of evidence to recreate the timing and nature of sediment deposition in these areas. Grain-size and sedimentary-structure analyses were the principal means of discerning the mechanisms of deposition. Radiocarbon dating of both natural and cultural materials, ceramic dating of archaeological sites, dendrochronological dating of living trees and driftwood, and relative dating of weathered limestone boulders were the principal chronometric methods used to establish age controls on the terrace deposits. Sorted by type and age, the depositional units were mapped onto aerial photographs, and later transformed into large-scale topographic maps.

As noted above, Lucchitta et al. (1995) mapped the Holocene terraces as a single unit, which he called the Cardenas Suite, or Archeologic Unit. Hereford subdivided this unit into five terraces and related alluvial deposits (Hereford 1996; Hereford, Thompson, Burke, and Fairley 1996; Hereford et al. 1993, 1997, 2000a, 2000b) (Figure 37). From oldest to youngest, the deposits were assigned field names as follows: Striped Alluvium, Alluvium of Pueblo II Age, Upper Mesquite Alluvium, Lower Mesquite Alluvium, and Pre-Dam Alluvium (these were mapped as sa, ap, umt, lmt, and pda, respectively). Surface expressions of aeolian and colluvial activity were also mapped, and several subsets of Post-Dam Alluvium were also recognized. These Holocene deposits form discontinuous terraces upstream of, downstream of, and surrounding Holocene-age debris fans at the mouths of tributary canyons. As described by Howard and Dolan (1981), and subsequently refined by Webb et al. (1987, 1989, 1996) and Schmidt (1990), Hereford found that debris fans played a critical role in determining the location of fine-sediment deposition within the river corridor. Hereford expanded on this previous research by demonstrating that the age and original form of large debris fans were crucial to understanding the timing and extent of prehistoric depositional events.

Hereford did not explore in depth the processes responsible for the formation of the prehistoric terraces, although like Karlstrom (1986), he noted in passing a close correlation between the ages of the terrace deposits in the Grand Canyon and those found in other, smaller

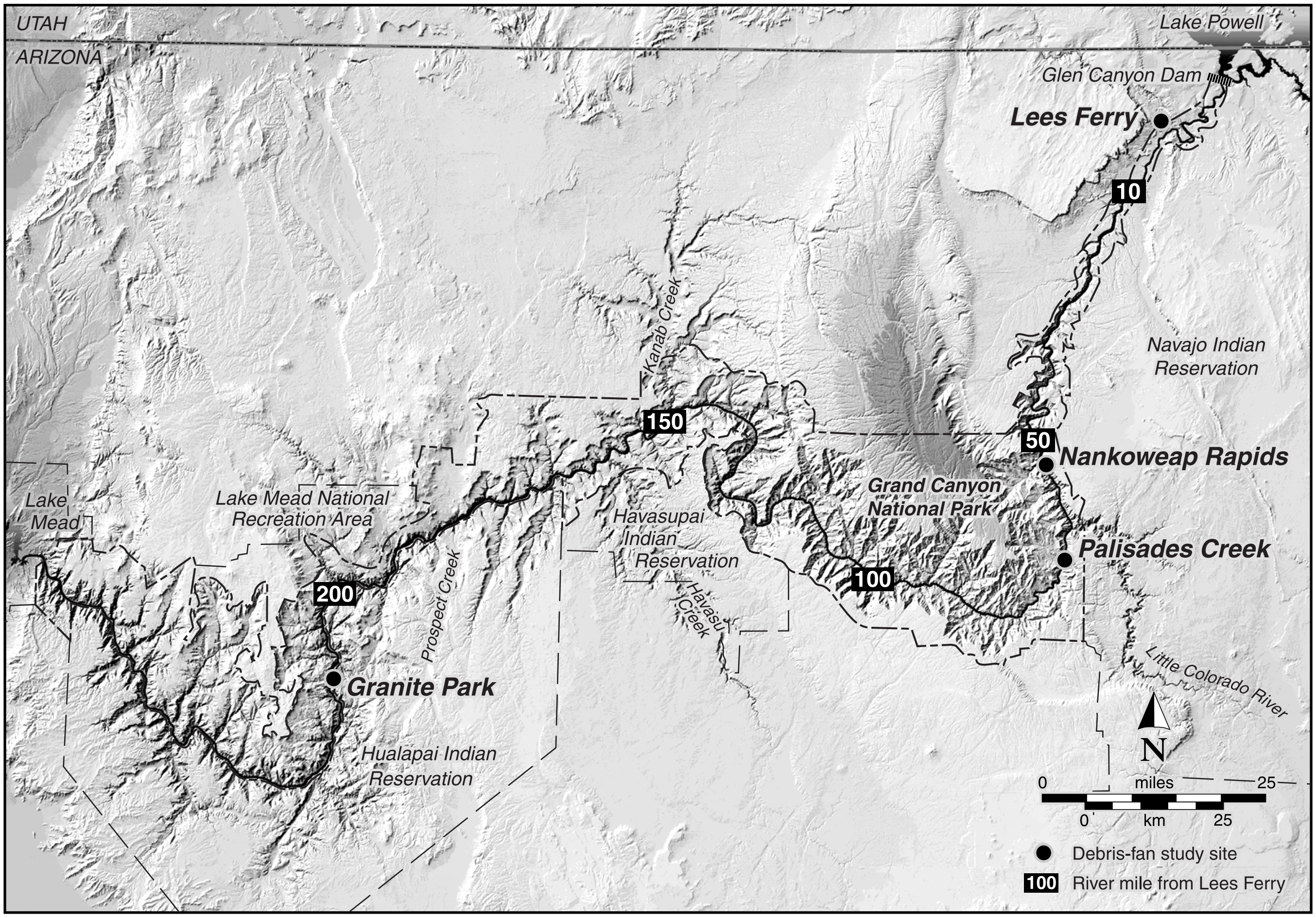

Figure 35. Map showing the locations of Lucchitta's and Hereford's geomorphic study areas.

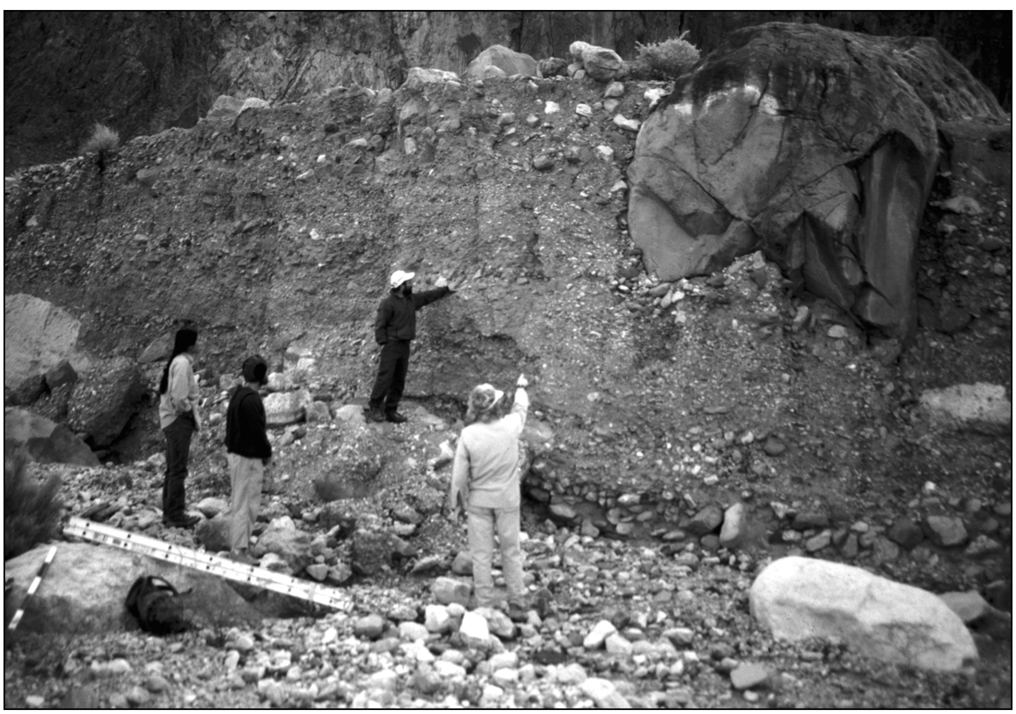

Figure 36. Geomorphologists examine the Palisades debris flow.

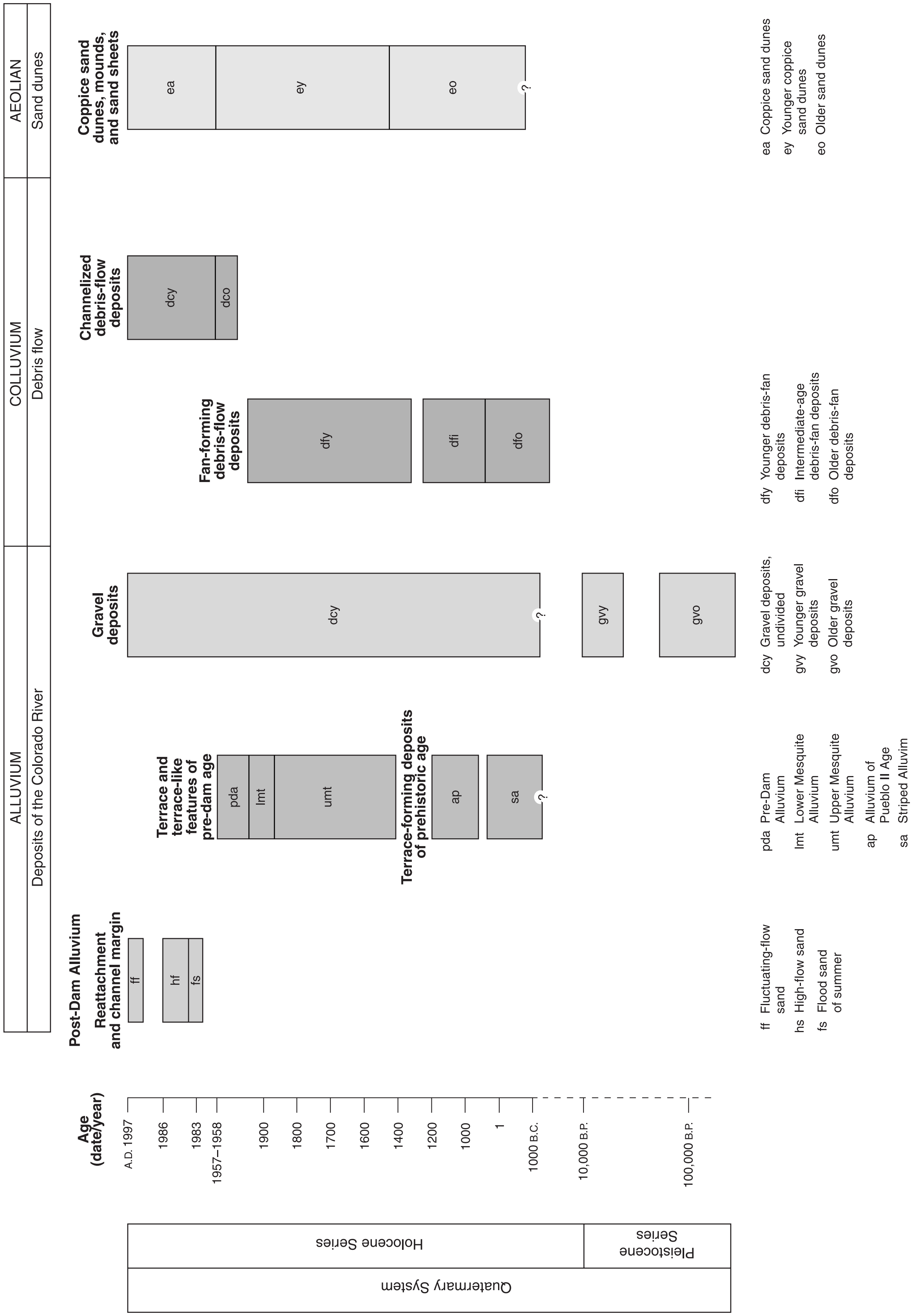

Figure 37. Quaternary deposits in the river corridor correlated with calendar years.

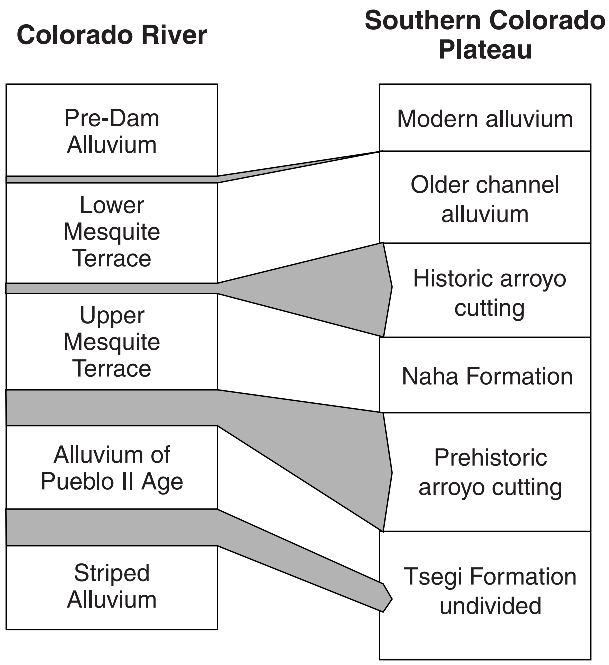

Figure 38. Correlation of Colorado River alluvial deposits and hiatuses with alluvial records elsewhere on the southern Colorado Plateau (after Cooley 1962; Dean 1988; Hack 1942; Hereford, Jacoby, and McCord 1996; Karlstrom 1988).

canyons of northeastern Arizona (Hack 1942; Karlstrom 1988) (Figure 38) and southern Utah (Hereford, Jacoby, and McCord 1996). To Hereford, this lent support to the idea that regional climatic factors were primarily responsible for the major terrace-forming events. Hereford focused attention on the factors responsible for erosion of the terraces in recent history, and he developed a working hypothesis to account for the relatively rapid rate of erosion of archaeological sites situated on or in the terraces within the past 30 years (Hereford et al. 1991, 1993).

Hereford's basic hypothesis can be summarized as follows: Under pre-dam conditions, archaeological sites were subject to the same fundamental processes of erosion that affect them today, namely gullying from runoff events and deflation from wind. However, in pre-dam times, these natural processes of erosion were ameliorated by the annual floods that deposited large quantities of sediment on terrace levels, which were well above the fall and winter flow levels, as well as in the mouths of tributary drainages (McKee 1938:77–78). These annual depositional events effectively raised the base level of the small tributary streams that drain the inner-canyon slopes and terraces, thereby reducing the amount of erosion caused by the minor tributaries in a typical year (Hereford et al. 1993). Hereford observed that even today, many of the small gullies draining the high terraces do not extend all the way to river, but instead debouch onto lower terrace surfaces that are, in some cases, several meters above the current river channel. Without restorative floods, these "terrace-based" drainages will eventually migrate out to the terrace edge and cut down to the river. This will result in a "rejuvenation" of the channel and a rapid headward migration of gully "nick points," as the gullies regrade their channels to the river's base level (Figure 39).

Hereford's hypothesis has been controversial, due in part to the fact that no quantitative data that supports or refutes it have been collected subsequent to its publication. It has also been controversial because some aspects of the hypothesis have been misrepresented by individuals who lack background in geomorphology. For example, Hereford et al. (1993:19–27) documented an apparent increase in the number, length, and apparent depth of gullies crossing terrace surfaces during the 1970s and 1980s, as shown by comparing a series of aerial photographs and historical photographs from a single area. After compiling and analyzing precipitation

Erosion of archaeological sites along the Colorado River

- 475 archaeological sites are recorded along the river
- 50 percent of these sites are located on river terraces
- Risk of erosion is greatest for sites situated on terraces

Drainage of the Colorado River corridor by short tributary streams

- Archaeological sites are eroded by short tributary streams
- During intense rainfall, these streams flow across terraces
- The streams are adjusting to a new, lower base level
- The lower base level is the result of regulated stream flow

River-based streams

- Currently drain to the Colorado River
- These streams have entrenched since closure of Glen Canyon Dam, causing erosion of archaeological sites
- Entrenchment resulted from lowering of stream gradient to the current level of the Colorado River

Terrace-based streams

- Do not reach the Colorado River; base level is an older, higher depositional level of the river
- Erosion of archaeological sites along these streams is unrelated to operation of Glen Canyon Dam
- Terrace-based streams have the potential to regrade to the post-dam level of the Colorado River, which will result in stream entrenchment and erosion of archaeological sites

Figure 39. Current and predicted effects of tributary streams on archaeological sites in the Colorado River corridor.

evidence from the region surrounding the Grand Canyon (Hereford et al. 1993:29–41), Hereford correlated this phenomenon with a marked increase in precipitation during the 1970s and 1980s. He concluded that precipitation, not dam operations, was the primary agent behind the erosion documented by the aerial photographs during the post-dam period, but that dam operations were affecting the depth and, consequently, the rate of gully erosion (Hereford et al. 1993:42). These distinctions have been overlooked or ignored by some subsequent critics of the model. Hereford concluded that dam operations, as well as the lack of sediment replenishment within the system in general, had significantly exacerbated the ongoing erosion of archaeological sites in the river corridor.

In the late 1990s, GCMRC contracted with SWCA, Inc., to develop a geomorphic model to help predict the likelihood of future archaeological site erosion. Building on the work of Hereford et al. (1993), Thompson and Potochnik (2000) developed a mathematical model based on a set of variables: geomorphic setting, drainage catchment area, soil characteristics, slope, and vegetation. They used this model to evaluate 122 sites in terms of whether they were at high, medium, or low risk for future erosion. They also identified a number of sites that appeared to be "past the point of no return" in terms of erosion. As of yet, none of the recommendations resulting from this project has been implemented. In particular, no attempt has been made to test the validity of the model by implementing a quantifiable monitoring program that could determine whether erosion is progressing as predicted at the evaluated sites. Meanwhile, the geomorphic specialists who participated as members of the Cultural PEP review panel criticized the Thompson and Potochnik model for its reliance on the Hereford hypothesis (Doelle 2000), with its emphasis on base-level factors over hillslope processes in determining rates of erosion. A recent remote-sensing project initiated by geomorphologists from Utah State University (Pederson 2000) plans to look specifically at hillslope factors as predictors of archaeological site erosion in the near future.

CHAPTER 4

Traditional Native American Perspectives on the Grand Canyon

The NHPA upholds the idea that "the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people." The law is premised on the understanding that historical places empower the past and bring historical perspective to our current lives. For much the same reason, Native American people revere the land on which they have lived for generations: The land embodies the stories of their ancestors and the all-important lessons that have been learned and handed down while living there. The land is, in a real sense, a physical representation of all their cultural traditions, providing a foundation for each person's identity as a part of a cultural entity.

This idea was recently expressed by N. Scott Momaday (1994:1) in an essay on Native American values: "From the time the Indian first set foot upon this continent, he centered his life in the natural world. He is deeply invested in the earth, committed to it both in his consciousness and in his instinct. The sense of place is paramount. Only in reference to the earth can he persist in his identity." Native American scholar Vine Deloria, Jr., states the same concept in a slightly different way: "American Indians hold their lands—places—as having the highest possible meaning, and all their statements are made with this reference point in mind" (Deloria 1992:62). Consider also the observations of John Wesley Powell, in reference to the Ute and Southern Paiute people more than a century ago: "An Indian will never ask to what nation or tribe or body of people another Indian belongs to but 'to what land do you belong and how are you land[-] named?' Thus, the very name of the Indian is his title deed to his home … ." (cited in Zedeño 1997:67).

For the diverse tribes currently living in the vicinity of the Grand Canyon—Havasupai, Hualapai, Hopi, Navajo, Southern Paiutes, and Zuni—the Colorado River and its magnificent chasm has great historical and symbolic significance for a variety of reasons. In connection with the Glen Canyon Dam Environmental Impact Study, each affiliated tribe prepared reports that conveyed the significance of the Grand Canyon and the Colorado River from their own particular traditional viewpoints. They did this without revealing any privileged or esoteric knowledge, a difficult task because many esoteric traditions and teachings are bound up with this landscape (Ferguson 1997; Hart 1995; Hualapai Tribe 1993; Roberts et al. 1995; Stoffle et al. 1994). The tribes made this concession in hopes of positively affecting the management of a place that has great importance to them.

This chapter summarizes the key values and issues of importance to the various Native American tribes that traditionally came from, lived in, or otherwise used the Grand Canyon and its immediate environs (Figure 40). These summaries serve mainly to highlight the diverse histories and unique viewpoints of the various tribes in relation to the place now commonly known as the Grand Canyon. They are in no way comprehensive. Entire books can be (and have been) written about the historical relationship between each tribe and the Grand Canyon (Ferguson 1997; Hualapai Tribe 1993; Roberts et al. 1995; Stoffle et al. 1994), although even these comprehensive treatments do not do justice to the complex web of relationships that governs Native Americans' past and present interactions with the Grand Canyon. Nevertheless, these documents offer the most comprehensive treatment of the topic available today, and readers are referred to these sources for additional information.

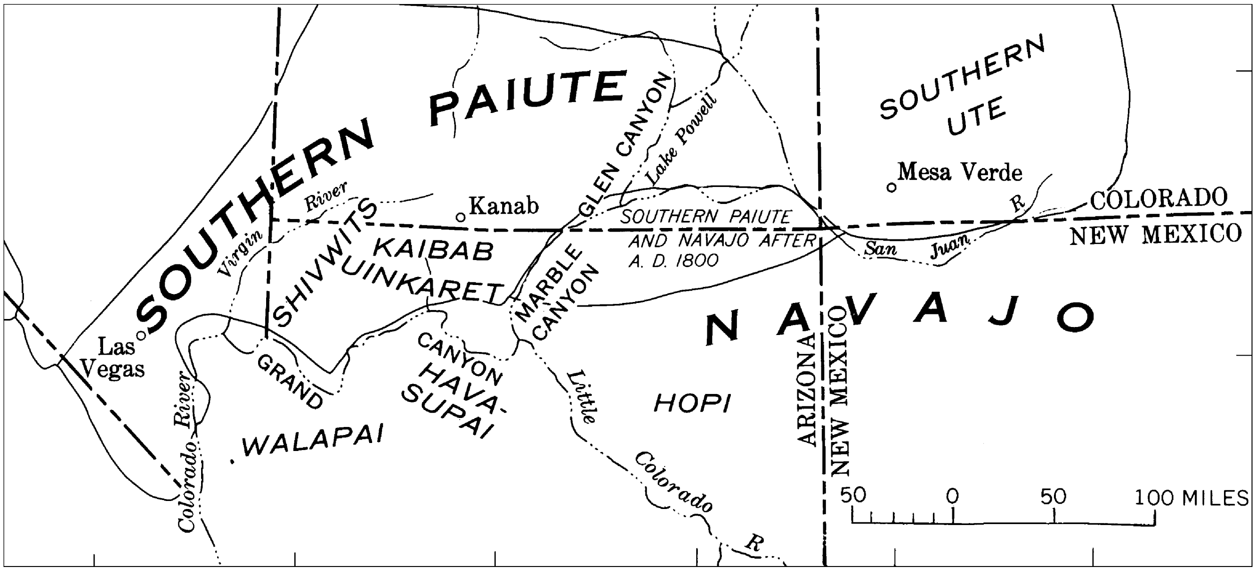

Figure 40. General location of Native American tribes in the Grand Canyon region.

Traditional Pai (Havasupai and Hualapai) Perspectives on the Grand Canyon

The following summary is primarily based on information prepared by the Hualapai Cultural Resources Division for the GCES Program (Hualapai Tribe 1993; Stevens and Mercer 1998). The reader is referred to the Hualapai Tribe, Cultural Resource Division, for permission to access these reports, which provide a much more detailed account of traditional and modern Pai perspectives about the Grand Canyon, the Colorado River, and the many associated resources of traditional importance to the Pai people. Secondary source materials compiled by Dobyns (1974), Kroeber (1935), Smithson and Euler (1994), and Spier (1928) were also consulted. This discussion emphasizes Hualapai perspectives on the Grand Canyon. Havasupai perceptions of the Grand Canyon and the Colorado River and its resources are somewhat different from that of their Pai relatives to the west; however, the Havasupai have elected not to be active participants in the Glen Canyon Dam Adaptive Management Program for both pragmatic and philosophical reasons (Neal et al. 2000:28).

According to Pai oral traditions, the Pai and other people came into existence to the west of the Grand Canyon at a place called Wikame (Spirit Mountain), also known by its Anglo name as Mount Newberry. Two fraternal deities, a younger brother named Hamatvi'l (or Mat'vila), and his older brother, Tu'djupa, created people from pieces of cane. Some time after humans were created, the ancestors of the people we now know as Hualapai, Havasupai, and Yavapai moved to Mat'wi'Ta Canyon. In some accounts (e.g., MacGregor, in Kroeber 1935:12–26), the older brother led them to the canyon country. Along the way, he taught the Pai all they needed to know in order to live successfully in the Grand Canyon: the names of the springs and other significant places, the uses of the plants, how to hunt, and the appropriate ways to live with the land. In other accounts (e.g., Ewing 1961), when the Pai moved to Mat'wi'Ta, they encountered a being living in a stone house inside a cave, who taught them the names of places and all the other things they needed to know in order to live there.

The people who would later become known as Hualapai, Havasupai, and Yavapai continued to live together until one fateful day, when some children began to squabble. Eventually, the parents became involved and took sides with the children. This led to escalating tensions between the two factions until the situation deteriorated and physical violence ensued. The event caused the Yavapai to split off from the Hualapai and Havasupai and become their mortal enemies, a relationship that remains more or less unchanged to the present day. After a while, the people who would become known as Havasupai split off from the other Hualapai bands and took up farming in Havasu Canyon.

Traditionally, the Hualapai used a wide variety of wild resources in the Grand Canyon, gathering plants from different environmental zones as each came into season and hunting virtually every available animal for food, fur, and hides. They maintained "base camps" near some of the most reliable water sources and planted small gardens there, which they irrigated from the springs. Bands of Pai

Figure 41. Burro, the last Havasupai resident of Indian Gardens (courtesy of the National Anthropological Archives of the Smithsonian Institution, OPPS Negative Number 53428-a).

returned to these springs year after year, and over time, some of these bands came to be named for their association with specific springs (e.g., Blue-Green Water, Clay Springs, Grass Springs, Milkweed Springs, Peach Springs, White Rock Water). Other bands acquired names from their association with prominent landforms, such as the Cerbat Mountains. The Hualapai continued to live in the Grand Canyon as scattered bands up until the nineteenth century. At the time of contact, 8–14 separate bands identified themselves on the basis of the places where they spent most of their time.

An extended period of conflict with American miners and military personnel culminated in the Walapai War of 1866–1869. One Pai band—the Havasupai—managed to steer clear of the conflict by remaining close to their summer gardens in Havasu Canyon at the eastern edge of Pai territory. Eventually, the remaining Pai bands were defeated and confined to a reservation comprising only a fraction of their former territory.

Today, the name of one specific Pai band (the Pine Springs People) is used to refer to the descendants of all the Pai bands except the Havasuapi. Because of historical circumstances (Dobyns and Euler 1960, 1970, 1999), the Havasupai (Blue-Green Water People) retained a separate identity as the easternmost Pai band. In protohistoric times and continuing into the historical period, Havasupai made use of the entire South Rim of the Grand Canyon as far east as Grey Mountain (Dobyns 1974). Individual families maintained gardens near several South Rim springs in addition to the main garden area in Havasu Canyon. Havasupai were still farming at Indian Gardens when the Grand Canyon was declared a National Park in 1919 (Hirst 1985:92) (Figure 41).

The Hualapai and Havasupai traded extensively with each other, as well as with their neighbors to the south, west, and east. In addition to serving as middlemen between the Mohave and Hopi in the exchange of shell and turquoise, they produced and traded many local products that were greatly valued by adjoining tribes, including finely tanned buckskins, dried agave, expertly crafted baskets, and red ochre. On occasion, they also exchanged esoteric knowledge, adopting songs and dances from each other (Smithson and Euler 1994:2). Social connections between the Havasupai, the Hualapai, and their old trading partners are actively maintained up to the present day.

For the Hualapai and Havasupai people of today, the Grand Canyon is, quite simply, home. Although it is not their place of origin, it represents the place where the Hualapai and Havasupai became an identifiable people distinct from neighboring tribes. According to their oral traditions, they were given this region as their homeland, instructed in how to care for it, and given the specific knowledge required to live on it successfully. They have resided there for as long as they or anyone else can remember. The spirits and stories of their ancestors are present throughout the Grand Canyon, and their stories are tied to the many springs and to certain geologic outcrops located throughout their traditional homeland (Stevens and Mercer 1998).

The river itself is the "spine," or "backbone," of this landscape (Ha'yitad). Today, as in the past, the river defines the northern limits of Pai territory. The traditional importance of the Grand Canyon and the Colorado River to the Pai is symbolized by the river's central placement within the official Tribal Seal of the Hualapai Nation.

Traditional Hopi Perspectives on the Grand Canyon

The following summary of Hopi traditional perspectives and cultural values associated with the Grand Canyon has been compiled primarily from information provided in Ferguson's (1997) *Oonga, Ongtupka, Niqw Pisivayu (Salt, Salt Canyon, and Colorado River), the Hopi People and the Grand Canyon*. This section offers a simplified and generalized account of a long-standing and complex relationship between the modern-day Hopi people, their ancestors, and this landscape. The reader is referred to Ferguson's (1997) comprehensive report for a more detailed discussion of the key points highlighted below. Other secondary sources that were consulted include Dongoske et al. (1993, 1997), Ferguson et al. (1993), Secakuku (2000), and Whiteley (1988).

According to traditional Hopi beliefs, the Hopi and all other people originated from a series of underworlds. In each of the preceding worlds, people and animals lived together and were able to communicate with each other, but invariably, human weaknesses led to a disintegration of the social order, and it was necessary to move to another world. After passing through three levels, humans eventually arrived at this, the fourth world, via a hole in the earth's surface. In most clan accounts, the place of emergence is specified as Sipapuni, a spring mound in the Little Colorado Gorge located a few miles upstream from the confluence with the Colorado River.

When people first emerged into this world, they saw footprints on the surface of the earth and knew that they were not alone. Shortly thereafter, they encountered Ma'saw, guardian of the earth, of fire, and of the underworlds. The people asked Ma'saw if they could live on the earth and Ma'saw agreed, provided that they keep a covenant with him to take care of the earth. The Hopi people agreed to these terms, and the covenant was sealed with their acceptance of Ma'saw's gifts of corn and a digging stick.

The covenant with Ma'saw requires that the Hopi plant corn and perform ceremonies that will ensure the perpetuation of life on earth. Water in all its forms (rain, clouds, springs, rivers) is a theme of central importance in Hopi cosmology. In keeping with their original covenant, Hopi ritual life is focused on ensuring the continuation of rain in all its manifest forms. Many aspects of Hopi ceremonies symbolically incorporate and pay homage to water, the source of life on this planet.

After people emerged into this world through Sipapuni and received their instructions from Ma'saw, they dispersed and spread out over the earth in all directions. Some, but not all, of the ancestral Hopi clans eventually returned to the Grand Canyon, living and farming there for a time. However, these ancestral clans knew that their destiny lay elsewhere and eventually moved on, ultimately arriving and remaining at the Hopi Mesas, 70 miles east of the Grand Canyon. It was during this time of clan migrations that most of the habitation sites, gardens, rock art, and other features attributed to ancestral Puebloan people were constructed in the Grand Canyon. Some of the ceremonies practiced today at the Hopi Mesas trace their origins to the time when the clans inhabited the Grand Canyon. Thus, the canyon is not only the place of origin for the Hopi people, but it is also the ancestral homeland of several Hopi clans. Perhaps most significant, the Grand Canyon is perceived as the place where spirits of deceased Hopi go to rejoin Ma'saw and relatives who have gone before.

Today, as in the past, the Grand Canyon supports a variety of animals and plants that were traditionally used by Hopi people as food, medicine, and fiber and for ceremonial purposes. Many of these plants and animals are still harvested and used today, but to a more limited extent than in the past. Modern uses of canyon resources are mainly ceremonial, rather than utilitarian, because the ready availability of manufactured products makes many traditional utilitarian uses obsolete. Some plants of importance to the Hopi are restricted to the riparian zone along the river or adjacent to tributary streams and seeps (Figure 42).

Figure 42. Members of the Hopi Cultural Resources Advisory Team examining riparian vegetation along the Colorado River (photograph courtesy of Michael Yeatts and the Hopi Tribe).

The Grand Canyon also provided life-sustaining salt and other minerals. Salt Woman is one of several ancestral deities embodied within the rock formations of the Grand Canyon. A successful visit to Salt Woman involved walking along the same path followed by the spirits of deceased Hopi as they return to the land of Ma'saw. A successful pilgrimage to the place of emergence and to the resting place of Salt Woman is testimony to the "Hopiness" of the individuals who undertake the journey, for only those with a pure heart and sufficient humility can expect to survive the rigorous and spiritually dangerous journey. Salt was proof of a successful pilgrimage. When the mineral arrived in the villages, however, it held no special power of its own and was used like table salt.

Hopi are familiar with and have long used a variety of routes and constructed trails throughout the canyon region to reach important canyon resources. Some, such as the Salt Trail, are viewed as having both secular and sacred purposes. Others were used simply to get from one place or resource patch to another. The "Moqui Trail," which linked the Hopi on the Mesas with the Havasupai in Cataract (Havasu) Canyon, was in active use four-and-half centuries ago when Spanish explorers first came to the region and was used regularly into the twentieth century (James 1900). This important trade and communication route was undoubtedly used for many centuries prior to the 1500s.

Like other Native Americans throughout the region, the Hopi consider the Colorado River and the Grand Canyon as integral to and inseparable from the larger landscape of which they form a part. This entire regional landscape is considered sacred by the Hopi because it embodies physical manifestations of the many mythical characters who they believe were critical in shaping human society and instructing the Hopi in proper ways of living. The landscape is a physical anchor for the many stories and ceremonial traditions that define and sustain Hopi people. Most important of all, the land is sacred because it sustains the people. It nurtured the Hisatsinom, ancestors of the Hopi people, whose spirits still inhabit this land, and it continues to sustain the Hopi people and their culture to the present day.

Traditional Navajo Perspectives on the Grand Canyon

The following generalized summary of Navajo traditional perspectives and cultural values associated with the Grand Canyon is compiled primarily from information provided in Roberts et al.'s (1995), *Bits'iis Nineeze (The River of Neverending Life), Navajo History and Cultural Resources of the Grand Canyon and the Colorado River*. The reader is referred to this source document for a more in-depth discussion of the key points highlighted below. Other secondary sources that were consulted include Kelley and Francis (1994), Locke (1989, 1990), and McPherson (1992).

According to traditional Navajo beliefs, the Dine originated from a series of underworlds. After passing through three or four levels, they eventually arrived at this world. In most accounts, the place of emergence is not specified, but some traditional accounts place it in Dinetah, the Navajo homeland in northern New Mexico and southern Colorado. When people first emerged into this world, it was covered with water. The first beings, through a series of epic events and battles, cleared the world of water. It was during this time, when the surface of the world was being drained, that the chasm of the

Colorado River—the Grand Canyon—was created. Water is of central importance in Navajo cosmology, and it is a central theme in many of the clan origin stories. The Colorado River is considered to be a source of protective and healing power for Navajo people. Prayers are offered to the river for protection from drowning before crossing, from death or injury during times of war, and for *hooz jo* (harmony, a good life) in general.

The Colorado River is perceived to be an animate being. Most Navajos think of it as a male being, whereas the Little Colorado is usually considered female, although these genders are not consistently applied. The river and the Grand Canyon are considered inseparable from the larger landscape of which they form an integral part. This landscape as a whole is considered sacred by Navajo people because of the sacred qualities of the original beings who created it, and because the landscape embodies physical representations of those beings. The landscape and its various landmarks serve to anchor in place the stories of the mythical past and the ceremonial traditions that define the Navajo as a people. This land is also sacred because it sustained and protected the people in the past, and because it continues to support and offer the necessities of life to present-day Navajo people.

The Colorado River and the Grand Canyon are believed by traditional Navajos to form a protective boundary around the western perimeter of Navajoland. The Grand Canyon provides protection to the Dine not only because it is the beneficiary of their offerings and prayers and provides water for ceremonial use, but also because it affords physical protection by virtue of its rugged, virtually impenetrable (to those unfamiliar with it) topography. In the nineteenth century, the Navajo people sought refuge in the remote reaches of the Grand Canyon, perhaps initially while hiding from Mexican slave raiders, and certainly in the early 1860s, while hiding from the U.S. Army. By successfully sheltering the people and sustaining them during this difficult time, the Grand Canyon became a symbol of protection for the Navajo people. In later, difficult times, such as the Dust Bowl era of the 1930s, Navajo people were able to find water for their livestock and patches of sand suitable for cultivation along the river. During the livestock-reduction program of the 1940s, some Navajo hid their sheep from federal livestock agents in the canyon. In these and other instances, the canyon offered a shield of protection that allowed the Navajo to survive hard times (Figure 43).

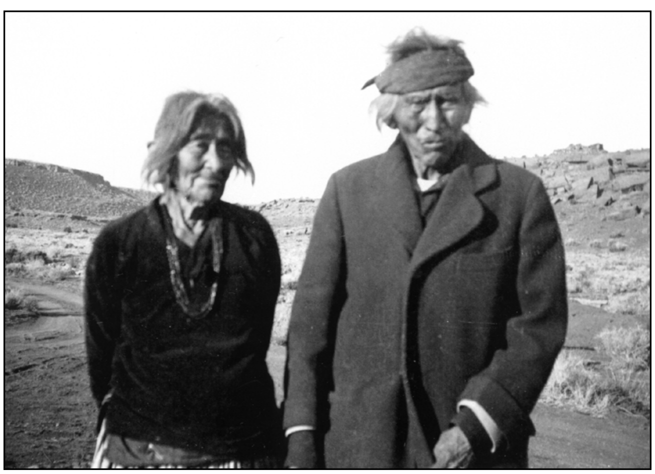

Figure 43. As a young boy, Peshlakai Etsidi, a resident of the Grand Canyon region, hid from Kit Carson within the canyon's interior during the early 1860s. He is shown here with his wife at Wupatki National Monument in 1935 (courtesy of the Museum of Northern Arizona, Harold S. Colton Research Center).

The Grand Canyon supports an abundance of animals and plants that were traditionally used by Navajo people and are still currently used, although less intensively. Some of the utilized plants are restricted to the inner canyon, and some grow only in the riparian zone along the river or by tributary streams and seeps. As with the Hopi, the canyon also provided life-sustaining salt for the Navajo, and they used a variety of routes and constructed trails in order to access these important canyon resources. Some of these trails are viewed as having both secular and sacred purposes, and some are mentioned in ceremonial stories.

Traditional Southern Paiute (The Kaibab, Shivwits, and Moapa Bands) Perspectives on the Grand Canyon

The following summary of traditional Southern Paiute perspectives of the Grand Canyon is derived primarily from Stoffle et al.'s (1994) *Piapaxa `Uipi (Big River Canyon): Southern Paiute Ethnographic Resource Inventory and Assessment for Colorado River Corridor, Glen Canyon National Recreation Area, Utah and Arizona, and Grand Canyon National Park, Arizona*. Additional sources of information were obtained from Fowler and Fowler (1971), Kelly (1934, 1964), Stoffle and Evans (1978), and Stoffle et al. (2000). Readers are encouraged to consult these sources for more a detailed discussion of the subjects highlighted below.

Like the Hualapai and Havasupai, the Southern Paiute believe they originated somewhere to the west of the Grand Canyon. The specific place where they were "released" on this earth varies from band to band, but very early in their history, they were directed to the Grand

Canyon region and learned how to live according to the Paiute way. They have lived in the Grand Canyon area, primarily on the north side of the river, for as long as anyone can remember. Long-standing oral traditions (e.g., Fowler and Fowler 1971:76–77) clearly reflect the Southern Paiute's perception of the Grand Canyon and the Colorado River as being both a secular and spiritual landscape.

In the past, the Southern Paiute resided seasonally in the canyon. According to Isabel Kelly (1964), the Southern Paiute lived in the Grand Canyon primarily during the late winter and spring. This was the time of year when winter stores were depleted and few wild foods were available on the plateau, but it coincides with the season when agave plants are storing up sugars in their root stalks in anticipation of producing flowers. The agave offered an important source of carbohydrates during a time of year when little else was available to eat; thus, the harvesting and roasting of agave hearts within the Grand Canyon was the main preoccupation of the Southern Paiute in late winter and early spring. Other important food resources were available in the Grand Canyon, such as cactus fruits and mesquite pods, which ripened later in the year. The Southern Paiute likely made periodic foraging trips into the canyon at these times as well. For much of year, however, they resided in base camps at higher elevations north of the Grand Canyon. Extended family groups claimed use rights to the most reliable springs in the region and returned to them on a more or less annual basis, planting irrigated gardens of corn, squash, and sunflower and foraging for wild plants nearby. Both the canyon interior and adjoining uplands supported herds of deer and bighorn sheep, which were avidly hunted by the Southern Paiute, along with smaller mammals such as rabbits, foxes, wildcats, and pack rats. Minerals, such as salt and red ochre, were collected from caves in the Grand Canyon. The ochre was traded to neighboring tribes and also to Mormon communities in the late nineteenth century.

Although ethnographers disagree about the names and precise territorial distributions of Southern Paiute bands in historical times, they agree that in the Grand Canyon region the Southern Paiute were loosely organized into band communities. Each band resided primarily within a specific geographic range that included a variety of water sources and physiographic and ecological attributes. The territories of some bands included portions of the Grand Canyon. According to Kelly (1934), the bands using the Grand Canyon at the time of contact with Euroamericans included the Shivwits, Uinkarets, Kaibab, and San Juan bands. Descendants of these historical bands maintain their traditional ties to the Grand Canyon, primarily by sharing stories and occasionally visiting places of cultural significance in the canyon or its tributaries. Today, many canyons and springs within the Grand Canyon have Paiute names, such as Kwagunt, Nankoweap, Parashant, Shinumo, Tapeats, and Unkar. The legacy of these place-names was passed on to John Wesley Powell and his surveyors by the Southern Paiute men who guided the explorers on their overland mapping expeditions in the early 1870s (Figure 44).

During times of social or climatic stress, such as in the 1860s, groups of Southern Paiute took refuge in the canyon and its tributaries, where they remained for an extended period of time. From time to time, individual bands also moved across the river and resided with their Pai neighbors (Smithson and Euler 1994:2; Stoffle et al. 1994:80–84). In 1889–1890, a nativist movement called the Ghost Dance was transferred by Paiutes living north of the river to the Pai people on the south side (Dobyns and Euler 1967; Stoffle et al. 2000). The transmission of this ceremony and the celebration of joint ceremonies may have occurred during cross-corridor visits by the tribes (Smithson and Euler 1994; Stevens and Mercer 1998:12).

Like most of their Native American neighbors, the Southern Paiute view the Grand Canyon landscape and its associated "resources" as animate and sentient entities. They believe that the rocks, springs, plants, and animals all have a life force, a "power" that must be acknowledged and respected by human beings. The world in general, and springs in particular, are inhabited by spirits that must be propitiated with appropriate offerings and prayers. The Grand Canyon region as a whole is considered not only a homeland, but also a holy land. The Southern Paiute term for this sacred landscape is Puaxantu Tuvip (Stoffle et al. 1994:22). For the Southern Paiute, the Grand Canyon and all of its constituent parts, which are integral components of Puaxantu Tuvip, deserve continuing respect and protection from negative human impacts.

Traditional Zuni Perspectives on the Grand Canyon

The following summary of traditional Zuni perspectives on the Grand Canyon is largely based on an unpublished report by Hart (1995), prepared with assistance from the Zuni Cultural Resource Advisory Committee for the Glen Canyon Dam Environmental Impact Statement. Additional sources of information include Dishta (1997), Ferguson (2001), and Chimoni and Hart (1994).

According to Zuni (A:shiwi) oral tradition, the Zuni emerged from the womb of the earth near Ribbon Falls

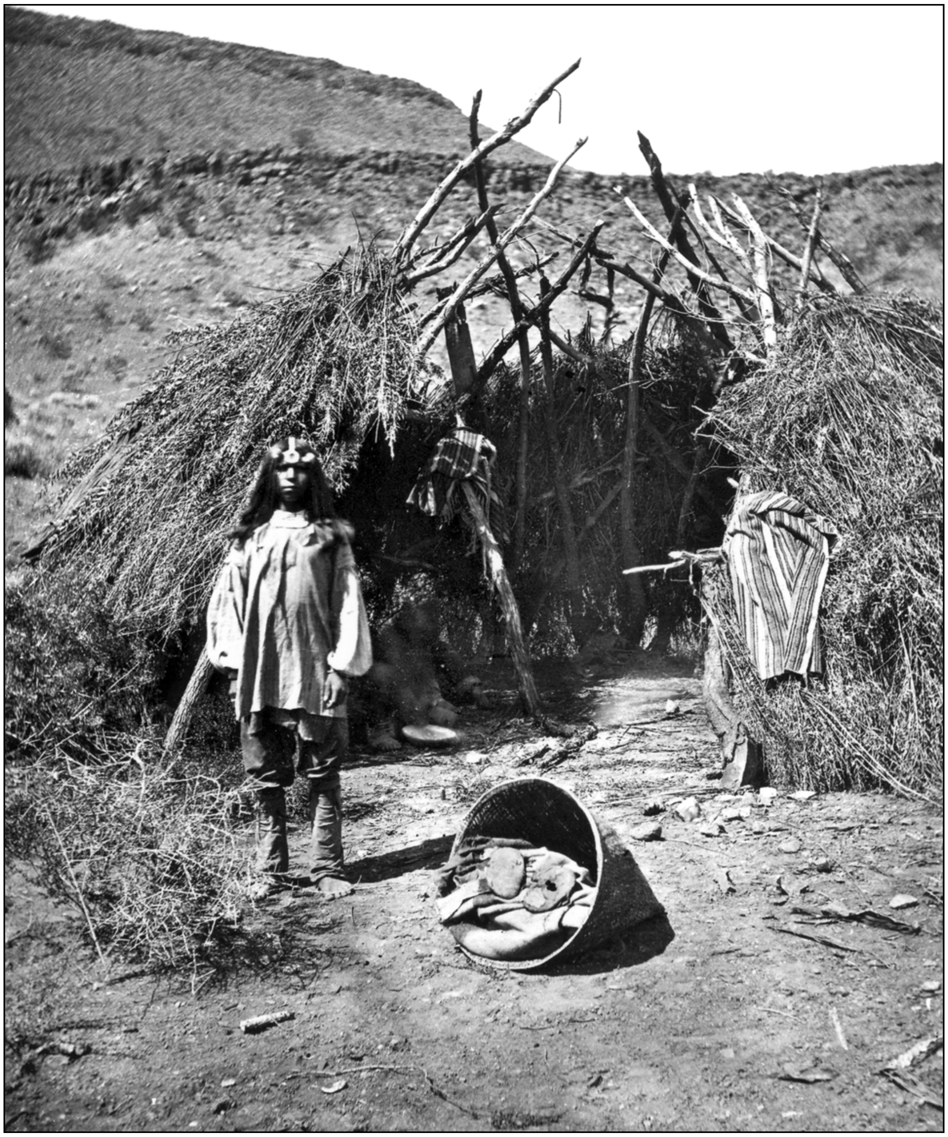

Figure 44. Tapeats, a Southern Paiute leader and guide/informant to John Wesley Powell in 1871–1872. A geological formation and several prominent geographical features in the Grand Canyon now bear his name (courtesy of the National Anthropological Archives of the Smithsonian Institution, OPPS Negative Number 1634).

in the heart of the Grand Canyon. Like the Hopi and most Navajo, they viewed this as the fourth world, having lived in three prior underworlds. According to the Zuni, the Havasupai and Hualapai emerged with them, whereas the Hopi emerged at the same time from a different place within the Grand Canyon (Hart 1995:3; cf. Dishta 1997:70–71). After they emerged, the Zuni began their long journey in search of Idiwana'a, the "Middle Place," where stability and equilibrium could be maintained and the people could find sustenance indefinitely (Chimoni and Hart 1994; Hart 1995).

When the A:shiwi first laid their eyes on the earth, it was in the Grand Canyon. Consequently, all of their first experiences in this world and the wonderful things that they initially observed in the canyon are highlighted in Zuni prayers, stories, and religious ceremonies: the place where sunlight first came over the rim; the plants, birds, and animals living along Bright Angel Creek and along the route followed to the Middle Place; and the sparkling minerals found in the canyon walls (Dishta 1997:70).

In their search for the Middle Place, the A:shiwi traveled eastward through the canyon, stopping at four springs during the course of their journey (Ferguson 2001). They then moved up along the Little Colorado River, stopping to build villages and plant corn along the way. Wherever they stopped, shrines were built and offerings were made (Dishta 1997:71). Those who died were buried at these places. At a spot near the junction of the Zuni and Little Colorado River, the A:shiwi had an important interaction with supernatural beings, the

Kokko. As a result, this came to be the place known as Kolhu/wala:wa, where deceased Zuni return when their life ends. Eventually, the Zuni found the Middle Place near the headwaters of the Zuni River, where they settled and remain to this day (Hart 1995:5).

Zuni religion and ceremonial life, like that of their Hopi neighbors, revolve around bringing rain, stability, and prosperity to the earth and its inhabitants. In the Zuni worldview, the place of emergence, Kolhu/wala:wa, and Idiwana'a, along with all of the intervening temporary stopping places, shrines, and burial sites form a continuous sacred landscape that is linked by the flowing waters of the Zuni, Little Colorado, and Colorado Rivers (Hart 1995:8) (Figure 45). Fulfilling the ritual requirements of their religion requires the Zuni to make periodic pilgrimages to places along the migration route, including the Grand Canyon, where plants, water, and minerals are collected from locations specified in traditional prayers. The ritually collected materials are subsequently used in ceremonies at the home villages (Chimoni and Hart 1994; Hart 1995:7).

In a 1994 presentation made to the Western History Association annual meeting in Albuquerque, New Mexico, Zuni leaders summarized their views about the sacred nature of the Grand Canyon and its many components. Although speaking specifically for the Zuni viewpoint, this statement seems to capture the essence of beliefs shared by all the tribes who live in and around the Grand Canyon (Chimoni and Hart 1994):

> Zunis do not make the same distinctions concerning "living" and "non-living" that many non-Indians make. To Zuni, the earth is alive. The walls of Grand Canyon, the rocks, the minerals and pigments there, and the water that flows between the walls of the canyon are all alive. Like any other living being, the earth can be harmed, injured and hurt when it is cut, gouged, or in other ways mistreated. So, we believe that the Grand Canyon itself is alive and sacred. The minerals used for pigments, the native plants and animals mentioned in our prayers and religious narratives, and the water of the river and its tributaries are sacred to us and should be protected.

Conclusion

The Grand Canyon encompasses different meanings to the various tribes who claim affiliation with the place. It is the origin place of the Hopi and Zuni people, the home of the Pai and Southern Paiute, and part of a mythological landscape and a historic place of refuge to the Navajo. To all the tribes, it is both a holy land and a homeland. It is also, at the same time, a "storyscape" (Stoffle et al. 1997:234–236). The mythical beings and ancestors who preceded the modern-day tribes in this region left signs of their passage in the hills, buttes, canyons, springs, and rock formations that give the land its unique character. In some cases, mythical beings were transformed into prominent landforms that are visible today. By remembering the stories that surround each feature and the connections between them, Native Americans are able to recall the lay of the land. Thus, at one level of meaning, the stories serve as verbal maps, a mythical representation of the physical landscape. In turn, the land and its many landmarks serve as a mnemonic template that preserves the ancient stories and traditions embedded within them (Basso 1996).

Archaeological sites and individual landmarks are important parts of the storyscape called the Grand Canyon, but they are just that: pieces of the story. It is the sum of those parts—all of the pieces linked together—that makes the story complete and fully meaningful. For this reason, an approach to determining NRHP eligibility that uses the district concept or the concept of a landscape-scale TCP is most compatible with Native American viewpoints about the traditional significance of the Grand Canyon.

Figure 45. Members of the Zuni Cultural Resources Advisory Team consult with a National Park Service archaeologist along the banks of the Colorado River (courtesy of Grand Canyon National Park Archaeology Program).

CHAPTER 5

Grand Canyon Culture History: Continuity and Change in a Dynamic Environment

This chapter presents a summary of Grand Canyon culture history based primarily on archaeological information derived both from the immediate vicinity of the Grand Canyon and from adjacent areas of the northern Southwest. Currently, Grand Canyon archaeologists estimate that less than 3 percent of Grand Canyon National Park has been inventoried for cultural resources (J. Balsom, personal communication 2003), and relatively few, mostly small-scale excavations have been completed within the park to date. Therefore, much of the Grand Canyon's reconstructed culture history relies on information derived from areas outside of the Grand Canyon. The relevance of these external data sources to the specific cultural trajectories within the Grand Canyon remains to be determined through future research. In addition, many ideas about Grand Canyon prehistory remain controversial. This can be attributed, in large part, to a lack of sufficient research on those specific aspects of prehistory and to the fact that past research has not been structured in a manner that can resolve the issues in question. For the most part, Native American perspectives about the past have not been incorporated into previous archaeological models of Grand Canyon prehistory. Therefore, in addition to summarizing what archaeologists presume to know about reconstructing the Grand Canyon's human history, the following discussion also highlights gaps in this body of knowledge and examines aspects of this history that have not yet been considered.

Although the history of human use of the Grand Canyon may extend back into the Paleoindian period (Altschul and Fairley 1989), the current evidence for human use of the canyon's interior prior to 8000 B.C. consists of one fragmentary Folsom point found on an eroded bench thousands of feet above the Colorado River (Grand Canyon National Park archaeology site files). As of yet, no evidence of alluvial deposits or soils dating to the Paleoindian time frame (ca. 12,000–8,000 B.C.) have been documented anywhere within the river corridor below Glen Canyon Dam, although some ancient alluvial remnants have been found upstream of the dam in tributary drainages of Glen Canyon (Agenbroad et al. 1986). Given the paucity of evidence for Paleoindian use of the river corridor, the following culture history summary begins with a discussion of the Archaic period (Table 2).

Table 2. Chronology

Temporal Period	Date Range
Archaic period	ca. 8000–1000 B.C.
Early Archaic	ca. 8000–5000 B.C.
Middle Archaic	ca. 5000–3000 B.C.
Late Archaic	3000–1000 B.C.
Preformative period	ca. 1000 B.C.–A.D. 400
Formative period	ca. A.D.400–1250
Early Formative	A.D. 400–1000
Late Formative	A.D. 1000–1250
Late prehistoric/ protohistoric period	A.D. 1250–1776
Historical period	A.D. 1776–1950

A Note on Dating

Throughout this chapter and the report as a whole, I have attempted to be consistent in expressing dates in terms of Roman calendar years, rather than radiocarbon years (before present, or B.P.), in order to maintain continuity in the discussion from one temporal period to the next. Exceptions to this general rule occur sometimes when referencing previously published work. In general, I have tried to follow the conventions of the journal *American Antiquity* (SAA 2003) when reporting previously published radiocarbon dates, using an error of one standard deviation (68 percent confidence) unless specifically stated otherwise. However, it is not always possible to be consistent in reporting radiocarbon dates because of the variety of conventions for reporting radiocarbon results used by researchers over the years and across disciplines. When sufficient information is provided in a published source to permit translation of B.P. dates into calibrated calendar years with a specific sigma range, I have done so; otherwise, I have employed the previous author's dating conventions, accompanied by a page-number specific citation.

The Archaic Period

Southwestern archaeologists use the term "Archaic" to denote both a temporal period and a way of life, or culture. When referring to the temporal period on the southern Colorado Plateau, the term encompasses the extensive span of time (approximately 7,000 years) following the disappearance of Paleoindian big-game hunting cultures and preceding the appearance of horticulture. In cultural terms, the Archaic refers to a hunting-and-gathering lifestyle focused on the seasonal exploitation of diverse plants and animals. This cultural pattern developed across most of the American continents following the demise of Pleistocene megafauna and the associated post-Pleistocene environmental changes. The shift in subsistence orientation was accompanied by many changes in residential patterns and in technology, including projectile point morphology, flaked tool assemblages, milling stones, textiles, and basketry.

Jennings and Norbeck (1955) were the first to recognize the great antiquity of this lifeway in the arid West, referring to it as the "Desert Culture." They proposed that this mobile, foraging adaptation to the arid Great Basin environment developed approximately 10,000 years ago and continued more or less unchanged into historical times. They also proposed that the pattern of seasonal transhumance practiced by historical Numic bands, as outlined by Steward (1938), provided a useful model for interpreting earlier hunter-gatherer sites in arid western North America. After the Desert Culture was recognized to be part of a much broader, continent-wide hunting-and-gathering adaptive pattern succeeding the Paleoindian period (Willey and Phillips 1958:107), the term Desert Culture was abandoned in favor of Desert Archaic (Jennings 1964). Ten years later, Jennings (1974:154) suggested yet another terminological revision—"Western Archaic"—to encompass the several regional expressions of the Archaic lifeway west of the Rocky Mountains; this label remains in use today. Although the term "Desert Culture" is now outdated, one still finds frequent references to it in literature about the Grand Canyon because of Euler's (1966b, 1967b; see also Emslie et al. 1987; Euler and Olson 1965) earlier use of the label in reference to the Late Archaic split-twig figurines recovered from caves in the Grand Canyon. (For a recent comprehensive review of the Archaic period in the American Southwest, see Huckell [1996].)

Dating of the Archaic on the Colorado Plateau has undergone numerous revisions over the past half century. Depending on the particular locality of the American Southwest being considered, the beginning of the Archaic may be placed at 6000, 7000, or 8000 B.C., and, in general, the dates are earlier in the west than in the east. The earlier appearance of a foraging lifeway in the western portion of the Southwest may reflect the geographic origin of this adaptive strategy in the Great Basin and its subsequent spread eastward across the Colorado Plateau. Alternatively, the perpetuation of a grassland habitat suitable for sustaining large-game species in New Mexico and the southern Plains could have permitted the continuation of a Paleoindian lifeway in the eastern Southwest for several millennia longer than in other portions of the Southwest.

Relying on a cluster analysis of projectile points recovered from two stratified cave sites on the northern Colorado Plateau, Holmer (1978) divided the Archaic into three temporal periods: Early Archaic (6350–4200 B.C.), Middle Archaic (4200–2600 B.C.), and Late Archaic (2600 B.C.–A.D. 450). Fairley (1989a) followed Holmer's template in devising a similar chronology for the Arizona Strip, although she relied on the dating of open-twined sandals from Sand Dune Cave by Lindsay et al. (1968) to push the beginning of the Archaic back to 7000 B.C. and used the earliest dates on corn then available (Smiley et al. 1986) to terminate the Archaic at approximately 300 B.C.

Based on his research at Cowboy Cave and other cave sites in the upper Colorado River basin, Schroedl (1976) proposed a series of phases to describe the Archaic in the Canyonlands region of the Colorado Plateau. Schroedl (1988, 1992) subsequently updated and modified his temporal framework to conform more closely with Holmer's sequence for the Archaic on the northern Colorado Plateau. Meanwhile, Geib (1996:37–38) recently proposed a somewhat different temporal sequence for the Glen Canyon region, which recognizes early, middle, and late Archaic periods, as well as four intermediate periods. Geib (1996:36) suggests that splitting the standard tripartite division of the Archaic into seven periods allows researchers to identify finer distinctions from one period to the next, thereby minimizing the masking of significant variability through time. The inconsistent use of labels (e.g., Middle Archaic, Late Archaic) to designate different temporal intervals in different spatial contexts is perhaps unavoidable, because archaeologists in different regions have relied on different evidence and criteria to distinguish one period from the next. However, this variability testifies to an ongoing problem with communication experienced by all southwestern archaeologists as they attempt to compare and contrast findings between different regions of the Southwest.

The main difficulty encountered by researchers who attempt to reconcile the different temporal schemes previously used to organize Archaic data from the Colorado Plateau is that each researcher has used a separate constellation of attributes to distinguish one Archaic period from the next. Thus, Schroedl (1976) relied primarily on changes in Archaic point typologies, whereas Berry and Berry (1986) relied on radiocarbon-date distributions. Geib (1996), on the other hand, used a combination of radiocarbon-date distributions and dating of diagnostic textile artifacts (e.g., sandals) in conjunction with Holmer's point typology, as well as trends in environmental data.

Reliance on a single, nonperishable, temporally diagnostic class of artifacts, such as projectile points, provides archaeologists with a convenient tool for organizing and analyzing archaeological materials within a temporal framework. However, as Flenniken and Wilke (1989) have argued, point types may not be particularly reliable as temporal markers because they reflect functional needs rather than cultural affiliations (cf. Bettinger et al. 1991). As has been noted by Adovasio (1980:40, 1986; Adovasio and Hyland 1997) and reiterated by Geib (2000:511), woven artifacts more faithfully reflect culturally meaningful differences through time; however, perishable artifacts are much less commonly recovered from archaeological sites than projectile points, so they are not as useful or efficient as temporal markers. Despite their obvious limitations, point types currently offer the most ubiquitous and convenient means for distinguishing Archaic temporal differences at the Grand Canyon, so it makes sense to use a chronological framework that relies primarily on changes in point types to distinguish Archaic use of the area over time. Insofar as studies of the Archaic period at the Grand Canyon are still in their infancy, for the purposes of this discussion we have retained the tripartite division of the Archaic as previously outlined in Fairley (1989a:90–97), with slight revisions of the beginning and ending dates for each period, as discussed below.

Early Archaic Period (ca. 8000–5000 B.C.)

In summarizing the prehistory of the Arizona Strip, Fairley (1989a:90–91) dated the beginning of the Archaic lifeway in the Colorado Plateau at approximately 7000 B.C., based on the earliest dates on open-twined sandals then available (Ambler 1984). More recently, in his detailed review of Archaic evidence from the Glen Canyon region, Geib (1996:16–27) proposed a beginning date approximately 1,000 years earlier. Geib's exhaustive analysis of the radiocarbon evidence from the Glen Canyon region coupled with his analysis of additional dates on sandals from the southern Colorado Plateau (Geib 2000) offers a convincing argument for placing the arrival of Archaic hunters and gatherers on the southern Colorado Plateau at or shortly after 8000 B.C., contemporaneous with the late Paleoindian period farther east.

In keeping with the original hypothesis posed by Lindsay et al. (1968:121), Geib (1996:29) postulates an eastward diffusion of people and technology from the Great Basin to the Colorado Plateau around 8000 B.C. The movement of Archaic hunter-gatherers onto the plateau ca. 8000 B.C. coincides with the final millennium of Cole's (1990) Pleistocene-Holocene Transition period and seems to mirror an accompanying shift in vegetative and faunal assemblages from lower to higher elevations during this crucial transitional period.

Unlike the Glen Canyon region and localities farther to the north and east, a coherent discussion of the Archaic occupation in the Grand Canyon is hampered by a lack of excavation data from both single-component, open Archaic sites and deeply stratified cave sites. Therefore, we are forced to rely on data from neighboring regions to estimate the timing of earliest Archaic use in the Grand Canyon. Fortunately, a growing body of evidence from both open and sheltered sites to the north, west, south, and east of the Grand Canyon allows us to make some general statements about the timing and extent of Early Archaic and Middle Archaic use of the

Grand Canyon region. As already noted, these statements rely heavily on assumptions about the temporal placement of certain key diagnostic artifacts, particularly dart points (Holmer 1978, 1980, 1986).

At least one example of a stemmed Lake Mohave–Silver Lake point has been recovered from the Grandview area of the South Rim (Fairley 1990), and two others have been found on the Arizona Strip (Fairley 1989a:89). To date, no examples have been found below the canyon rim. As previously noted, west of the Grand Canyon (e.g., Bedwell 1970, 1973; Davis 1967; Warren 1967), this point style has been equated with the late Paleoindian period (ca. 8000–6000 B.C.), whereas to the east, similar-looking Jay points have been assigned to an Early–Middle Archaic time frame (Irwin-Williams 1979). The assumed temporal placement of this point style sometime between 8000 and 6000 B.C. in the Grand Canyon region overlaps with the revised beginning date for the Archaic period at 8000 B.C.

Pinto points appear to be another key diagnostic of the Early Archaic period on the western Colorado Plateau. Relying on the analytical work of Jennings and his students (Holmer 1978, 1980, 1986; Jennings et al. 1980; Schroedl 1977, 1988), Fairley (1989a:94) disputed Euler and Olson's (1965) claim that Pinto points were contemporaneous with the now well-dated Late Archaic split-twig figurines in the Grand Canyon (see also Euler 1983, 1984:9). Elsewhere on the northern Colorado Plateau, these distinctive stemmed points have been found in Early Archaic contexts at Sudden Shelter (Jennings et al. 1980) and also to the west of the Grand Canyon at O'Malley Shelter (Fowler et al. 1973). Holmer (1986:97–99) built upon the work of Thomas (1981:37–38) to demonstrate that confusion over the dating of Pinto points—also known as the "Pinto Problem" (Warren 1980)—appears to be the result of morphological similarity between this early, stemmed, basally notched and ground dart point and the much later Gatecliff Split-stemmed type.

Recently, Geib (1996, 2000) compiled a suite of dates on another key diagnostic of the Early Archaic: open-twined sandals. He demonstrated that Lindsay et al. (1968:95–97) were correct in identifying this sandal type as an important diagnostic of the Early Archaic in the Glen Canyon region and the northern Colorado Plateau. The co-occurrence of open-twined sandals with Pinto points in Stratum IV at Dust Devil Cave and in Burial 2 at Sand Dune Cave (Ambler 1996:49; Lindsay et al. 1968:46) lends credence to the identification of Pinto points as a temporal diagnostic of the Early Archaic in the neighboring Grand Canyon, as these two sites are located less than 120 miles northeast of Red Butte and the Grandview area of the Grand Canyon, where several Pinto points have been found (Euler 1983; McNutt and Euler 1966).

In addition to Pinto points, Holmer (1978) identified Northern Side-notched and Humbolt Series points as diagnostic of the Early Archaic on the northern Colorado Plateau. Both of these types have been identified from sites on the North and South Rims of the Grand Canyon, albeit in small numbers (Schroeder 1997; Schroedl 1988). Elko Corner-notched and Elko Side-notched points, another common type in the Grand Canyon, also made their appearance during the Early Archaic (Holmer 1978, 1986), but because this point style continued to be used for many millennia thereafter, it is not particularly useful for distinguishing specific temporal periods.

Aside from acknowledging the widespread existence of Early Archaic point types in the Grand Canyon region, the evidence that is currently available does not allow us to say much about the nature of Early Archaic occupation or the specific adaptive strategies employed during this time period. Early Archaic subsistence, technology, and settlement data from the Grand Canyon are essentially nonexistent, so, at present, one can only speculate about the adaptive characteristics of this early occupation based on information derived from surrounding regions. Evidence from excavated cave sites in the Glen Canyon region and farther upstream in Utah indicates that at least some Early Archaic sites were reused repeatedly over long periods of time, suggesting that Early Archaic foraging activities were organized around residential base camps (Geib 1996:31). The Early Archaic occupations at Cowboy Cave (Jennings 1980) and at Dust Devil Cave (Ambler 1996) have been independently interpreted as winter base camps, based on the faunal, floral, and artifactual assemblages (Schroedl and Coulam 1994:22). Typically, these winter camps were located in large alcoves strategically situated in mid-elevation areas between riverine lowlands and forested highlands. If this pattern extends beyond the Glen Canyon–Canyonlands region, then one could predict that Early Archaic winter base camps in the Grand Canyon region would be located in large overhangs on the canyon's South Rim and far western North Rim, as well as perhaps in the interior benchlands in the eastern Grand Canyon, but probably not along the river corridor. Indeed, virtually all of the Pinto points recovered to date from the Grand Canyon have been found on, or just slightly below, the South Rim, often as part of highly dispersed, low-density lithic scatters.

Given their presumed dependence on a wide assortment of plant and animal species, it seems highly unlikely that Early Archaic foragers would have confined their activities to the canyon rims; therefore, one could reasonably predict that short-term hunting and plant-processing stations would be present at lower elevations within the canyon, as well as at higher-elevation locations along the North Rim. Early Archaic remains have been identified in high-elevation settings on the North Rim (Schroedl 1988), but the exposed setting of these sites was not conducive to the preservation of organic remains; hence, they did not contribute any substantial data on seasonality, subsistence, or perishable technology. As of yet, no Early Archaic sites have been identified anywhere within the Grand Canyon. The erosion of Pleistocene soils from canyon slopes and benches, the apparent flushing of late Pleistocene–early Holocene alluvial sediments from the canyon bottom, and the accompanying shifts in vegetation during the early Holocene (Cole 1990) reduce the likelihood of encountering intact Early Archaic temporary camps and food-processing stations in open settings within the canyon's interior. As elsewhere in the Southwest, protected rockshelters with deep, stratified deposits offer the best setting for recovering Early Archaic remains within the Grand Canyon.

Middle Archaic Period (ca. 5000–3000 B.C.)

Fairley (1989a:94) dated the Middle Archaic period on the Arizona Strip between 4250 and 2650 B.C., based largely on Holmer's (1978:78) temporal placement of several key diagnostic dart points from the northern Colorado Plateau. Geib (1996:8) recently proposed somewhat different dates for the Middle Archaic in Glen Canyon, based on the timing of the abandonment of several previously intensively used cave sites in the upper Colorado River Basin in conjunction with an overall noticeable decrease in radiocarbon dates from the region between ca. 6000 and 4000 B.P. (4870–2490 cal B.C.) (Geib 1996:8). Inasmuch as the Grand Canyon region sheds little direct light on the temporal boundaries of the Middle Archaic, and to facilitate comparisons with adjacent regions, we have revised the beginning date of the Middle Archaic to correspond more closely with Schroedl's (1988, 1992) and Geib's beginning dates for this period, recognizing that as more information becomes available from the Grand Canyon, these dates may require further refinement. However, we depart from previously published frameworks (Altschul and Fairley 1989; Geib 1996; Schroedl 1992) by establishing the end date of the Middle Archaic at 3000 B.C. This change has been made to accommodate the earliest radiocarbon dates on split-twig figurines, a key diagnostic artifact of the Late Archaic period on the northern Colorado Plateau and the artifact most frequently associated with the Archaic occupation of the Grand Canyon. Currently, the oldest reported date on a split-twig figurine comes from Stanton's Cave, with an uncalibrated date of 4095 ± 100 B.P. (Euler and Olson 1965:368–369) (2870–2485 cal B.C., according to Coulam and Schroedl [2004]). It should be noted, however, that the proposed end date for the Middle Archaic at 3000 B.C. falls nearly midway between Schroedl's and Geib's proposed end dates for the same time period (3300 B.C. versus 2500 B.C., respectively).

Throughout the American Southwest, current perceptions of the Middle Archaic period are strongly influenced by Antevs's (1955) concept of the Altithermal, a supposedly prolonged interval of severe drought lasting from about 7500 to 4000 B.P. (Antevs 1955:329) (approximately 6340–2490 cal B.C.). The original Altithermal concept has been widely criticized, with more-recent studies revealing considerable climatic variability across the Southwest during the middle Holocene (Davis 1984; Hall 1985; Van Devender et al. 1987). Nevertheless, the basic premise that the middle Holocene was a period with generally higher temperatures and less effective moisture than either previous or subsequent periods remains viable (Geib 1996:33; Grayson 1993).

In terms of human activity, the Middle Archaic is generally considered to have been a time of low population density and dispersed settlement throughout the Colorado Plateau region. Berry and Berry (1986) relied on the virtual absence of radiocarbon dates between 4000 and 3000 B.P. to argue that humans essentially abandoned the Colorado Plateau during this interval. Other researchers (e.g., Fairley 1989a:94; Geib 1996, 2000; Schroedl 1988) have disputed the Berrys' conclusions, however, and suggested instead that Benedict's (1979) "Altithermal refugia" hypothesis could more readily account for the scarcity of Middle Archaic dates on the Colorado Plateau. In other words, rather than reflecting regional abandonment, the paucity of Middle Archaic radiocarbon dates from Colorado Plateau sites may reflect a regional shift in settlement-subsistence strategies, as the unusually hot and dry middle Holocene climate drove people out of low- and mid-elevation zones into cooler, moister high-elevation habitats.

The Altithermal refugia hypothesis finds some support in the known distribution of Middle Archaic point styles and radiocarbon dates from the Grand Canyon region and neighboring Glen Canyon. Although still sparse compared to the following period, a few (and a steadily increasing number of) Middle Archaic dates and artifacts have been recovered from scattered high-elevation localities bordering the Colorado River during the past two decades. During a survey of the Highway 67 right-of-way across the Kaibab Plateau (Fairley et al.

1984) and subsequent excavations at several sites within the highway corridor (Schroedl 1988), projectile points characteristic of the Middle Archaic on the northern Colorado Plateau were documented, including Rocker Side-notched and Sudden Side-notched points. In the Glen Canyon region, a buried hearth in a well-watered tributary of the Escalante drainage produced one solid Middle Archaic date (Agenbroad et al. 1986), leading Geib and others (1996; Geib, Fairley, and Ambler 1986; Geib, Fairley, and Bungart 1986) to speculate that in addition to using high-elevation areas, Middle Archaic foragers also found refuge in low-elevation areas near perennial water sources. Geib's recent reanalysis of artifacts from Benchmark Cave and other Glen Canyon sites has produced several additional Middle Archaic radiocarbon dates on plain-weave sandals (Geib 2000) from the Colorado River corridor upstream from Glen Canyon Dam. Assuming that the Middle Archaic refugia hypothesis holds for the Grand Canyon region, then alluvial deposits along the Colorado River dating prior to 4000 B.P. (approximately 2500 B.C.) warrant close examination for evidence of human occupation because these alluvial deposits could contain critical evidence pertaining to this sparsely studied and poorly understood Archaic period. The stretch of the Colorado River between Lees Ferry and Badger Canyon is known to contain alluvial deposits dating prior to 4000 B.P. (O'Connor et al. 1994). Deposits of equivalent age are known to occur upstream from Lees Ferry as well (Leap and Neal 1992).

Recently, Geib (1996) suggested another possible explanation for the apparent abandonment of several formerly heavily used northern Colorado Plateau caves and the relative paucity of Middle Archaic data from the Colorado Plateau in general. He speculates that the paucity of well-documented Middle Archaic sites may be due to a shift from a residentially based foraging strategy to a more wide-ranging, highly mobile collecting strategy in response to the environmental changes brought about by the drier, warmer climatic regime (Geib 1996:34). A shift from repeatedly occupied base camps to short-term, temporary, logistical camps would result in a very different archaeological record, one largely composed of low-visibility sites that would be much harder to detect and more likely to be dismissed by archaeologists as insignificant. Geib's hypothesis warrants further examination and underscores the need to record and analyze low-visibility sites in future regional studies of the Archaic.

Late Archaic Period (3000–1000 B.C.)

The Late Archaic is without doubt the best-known and most celebrated preceramic period in Grand Canyon prehistory. This is mainly because of the early discovery and subsequent emphasis on the study of the distinctive split-twig figurines (Figure 46) recovered from numerous cave sites within the Grand Canyon (Emslie et al. 1987, 1995; Euler 1984; Farmer and DeSaussure 1955; Schroedl 1977; Schwartz et al. 1958).

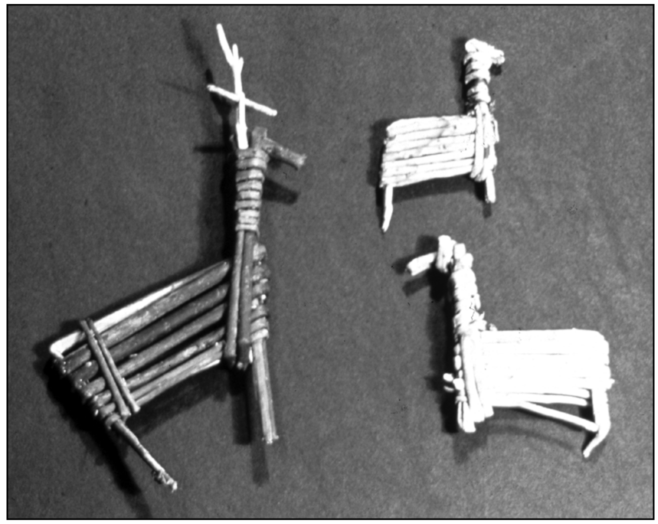

Figure 46. Split-twig figurines from Stanton's Cave (courtesy of Grand Canyon National Park Archaeology Program).

As with the preceding periods, considerable terminological confusion surrounds the dating of the Late Archaic on the Colorado Plateau. Relying primarily on the temporal placement of Late Archaic point types, Fairley (1989a:96) bracketed the Late Archaic on the Arizona Strip between 2650 and 300 B.C., whereas to the north, Schroedl (1992) dated the Late Archaic–Green River phase between 3300 and 1500 B.C. Following a somewhat different approach that incorporates textile and paleoclimate data, Geib (1996:8) dated the Late Archaic in Glen Canyon between ca. 2500 and 400 B.C. (ca. 4000–2400 B.P.). If we accept split-twig figurines as a key diagnostic of the Late Archaic in the Grand Canyon—they are currently the only directly dated Archaic artifacts from the Grand Canyon—then the time framework proposed here encompasses all available dates on twig figurines from the Grand Canyon (Coulam and Schroedl 2004; Horn 2001). For the purposes of this discussion, the end of the Archaic is defined by the introduction of cultigens on the southern Colorado Plateau at approximately 1000 B.C. (Smiley 1994).

As noted previously, considerable debate exists in the literature concerning the lithic tool correlates of split-twig figurines in the Grand Canyon. Euler initially proposed that Pinto points from the Grand Canyon region were made by the same people who made the split-twig figurines. However, Schroedl (1977) convincingly argued that Pinto points were much earlier than split-twig figurines on the Colorado Plateau, whereas Gypsum points were contemporary. Evidence for the Early Archaic affiliation of Pinto points has already been discussed above. Support for the contemporaneity of split-twig figurines and Gypsum points comes from Cowboy Cave (Jennings et al. 1980; Schroedl and Coulam 1994), Etna Cave (Fowler 1973), and Newberry Cave (Davis and Smith 1981), where Gypsum points were recovered from the same stratigraphic levels as split-twig figurines. Other rockshelter sites in the Great Basin have yielded Gypsum points from dated stratigraphic contexts that are clearly contemporaneous with split-twig figurines in the Grand Canyon. Gypsum points have also been recovered from one site on the Kaibab Plateau that was dated by obsidian hydration to the Late Archaic (Schroedl 1988:236, 374–375). Geib (1996:35) suggests that the distribution of Gypsum points seems to be restricted to the northern Colorado Plateau. South and east of Glen Canyon, Late Archaic points are dominated by large, triangular, corner-notched forms (Parry and Smiley 1990:55). It is interesting to note that the Highway 67 project recovered nine untyped corner-notched dart points from one site on the Kaibab Plateau, associated with a radiocarbon date of 3350 ± 90 B.P. (1743–1525 cal B.C.) on wood charcoal (Schroedl 1988:57). The fact that this presumably Late Archaic site contained no contracting stem points led Brown (1988:237) to speculate that Gypsum points might be temporally restricted in the Grand Canyon region prior to 1500 B.C.

In addition to Gypsum points, other points considered to be diagnostic of the Late Archaic in the Grand Canyon–Arizona Strip region include McKean (and other small lanceolate forms), San Rafael Side-notched, and Elko Eared (Holmer 1978, 1986; see also discussions in Brown [1988:211–247] and Fairley [1989a:96–97]). Despite the apparent widespread occurrence of these various Late Archaic point types in and around the Grand Canyon (Bungart 1994:61–62; Fairley 1989a:98; Schroeder 1997), virtually all published studies concerning the Late Archaic period in the Grand Canyon have focused on split-twig-figurine sites, which typically do not contain associated artifacts or any evidence of domestic functions (Emslie et al. 1987, 1995; Euler 1984; Horn 2001; Reilly 1966; Schroedl 1977; Schwartz et al. 1958). To date, more than 200 split-twig figurines have been recovered from at least 12 separate cave sites within the Grand Canyon (Horn 2001), and all dated specimens from the Grand Canyon range in age between ca. 4200 and 3000 B.P. (2870–1485 cal B.C.) (Coulam and Schroedl 2004).

The work of Emslie et al. (1987, 1995) has been particularly instrumental in furthering our understanding of the split-twig-figurine complex at the Grand Canyon. Emslie and his associates established that split-twig figurines were consistently deposited in ritualized contexts within the Grand Canyon. Although a ritual function for figurines had been posited early on (Gunnerson 1955; Reilly 1966; Schwartz et al. 1958), Emslie et al. were able to demonstrate this unequivocally, based on studies of several remote and undisturbed Grand Canyon caves. They found that split-twig figurines are usually deposited in Redwall Limestone–solution caverns containing extinct Pleistocene fauna, especially Harrington's mountain goat (*Oreamnos harringtoni*). The figurines were carefully placed, often on beds of grass, under deliberately constructed cairns of rock or stacked slabs of indurated pack-rat midden. Recently, Horn (2001) reported a series of dates on figurines found under cairns in a single cave. The distribution of dates appears to corroborate Emslie et al.'s (1987, 1995) hypothesis that the cairns represent a series of separate visits by Late Archaic people over several centuries.

The Grand Canyon split-twig-figurine data, in conjunction with studies on split-twig figurines from surrounding areas (e.g., Davis and Smith 1981; Jennings 1980; Olson 1966; Pierson and Anderson 1975), shed considerable light on the distribution and regional variations of Late Archaic split-twig figurines and their makers. Janetski (1980) and Davis and Smith (1981) have described several variations in figurine construction that seem to correlate spatially with different portions of the Great Basin and Colorado Plateau. Schroedl (1977) and Schroedl and Coulam (1994) documented temporal variations in these styles and demonstrated changes in functional contexts through time, with the earlier "Grand Canyon" style figurines typically found in ritualized, nonhabitation contexts, whereas the later "Green River"–style figurines are typically found in the middens of residential shelters. Based on an ethnographic analogy with modern arid-land hunter-gatherers, Coulam and Schroedl (2004) recently proposed that split-twig figurines may have represented a clan totem, perhaps of a single patrilineal clan whose territory was originally centered in the Grand Canyon.

Aside from the intensive focus on split-twig figurines, our current knowledge of Late Archaic occupancy and use of the Grand Canyon region remains fairly limited. We still know next to nothing about the range of site types used during this period or about the settlement-subsistence practices, exchange systems, social organization, and nonritual activities of Late Archaic hunter-gatherers. Indeed, much of the popular literature on Grand Canyon prehistory (i.e., Euler 1967b; Hughes 1978; Jones and Euler 1979) seems to imply that Late Archaic activities in the Grand Canyon were restricted to the ritual placement of split-twig figurines in caves, with domestic and subsistence activities presumably taking place somewhere beyond the canyon rims. This perspective has begun to change in recent years (e.g., Coder 2000), as an increasing number of open lithic sites with Gypsum and other distinctive Late Archaic points have been recorded on both the North and South Rims of the canyon (Fairley 1990; Schroeder 1997). Most Late Archaic points from Grand Canyon National Park have been found as isolates in highly eroded contexts or at sites that exhibited little or no stratigraphic depth, making further study and interpretation fruitless. Coulam (1986) tested one lithic site with Gypsum points on the canyon's North Rim, and Schroedl (1988) reported on the excavation of several Late Archaic sites on Kaibab Plateau. Slightly farther afield, Brown (1982) excavated some Late Archaic remains on the Arizona Strip, near Hack Canyon. Because of their shallow depth and open setting, however, none of these excavations added materially to our understanding of Late Archaic use of the Grand Canyon, aside from demonstrating that Late Archaic people made use of high-elevation areas and procured obsidian from diverse sources both north and south of the Grand Canyon.

In addition to split-twig figurines and dart points, certain styles of rock art may be attributable to Late Archaic people in the Grand Canyon. During the 1990–1991 river-corridor survey, several previously recorded petroglyph panels were relocated and rerecorded in the 15-mile stretch between Lees Ferry and Glen Canyon Dam (Clark 1991). Some of these panels are heavily repatinated with desert varnish and exhibit design attributes corresponding to Turner's (1963, 1971) Style 5. Turner initially assigned Style 5 to a pre–Pueblo II time frame, based on the superposition of later Style 4 (Basketmaker) elements. Schaasfma (1980) subsequently attributed Turner's Style 5 to the Late Archaic, based in part on visual similarities of the linear "boxy" sheep glyphs to split-twig figurines. Another distinctive rock-art style common to the western reaches of the Grand Canyon that may be Late Archaic is the Grand Canyon Polychrome style (Allen 1988). Schaasfma (1990:229) tentatively assigned this style to the Late Archaic period (or possibly earlier), based on general similarities to the presumed Middle–Late Archaic Barrier Canyon style on the northern Colorado Plateau.

Until the mid-1980s, when Tipps (1984) radiocarbon dated organic materials from preceramic levels at Captain's Alcove, evidence for Late Archaic activity along the banks of Colorado River was limited to the split-twig figurines in Stanton's Cave and the numerous Style 5 petroglyhs in Glen Canyon. In the western Grand Canyon, Jones (1986) tested a midden near the mouth of Whitmore Wash that produced one radiocarbon date on wood charcoal associated with a San Pedro–like point. Jones attributed this evidence to Basketmaker II use, although the 2-sigma calibrated radiocarbon date of 1365–905 B.C. (Jones 1986:105) is more consistent with a Late Archaic period assignment. Geib (1996:17–25) subsequently ran a series of radiocarbon assays on curated perishables from several shelters in Glen Canyon excavated by the University of Utah in the 1950s. These revealed that a number of the sites assumed to be exclusively Puebloan in age had previously been occupied by Late Archaic hunter-gatherers.

Within the Grand Canyon proper, the 1990–1991 intensive survey of the river corridor produced a small number of diagnostic Late Archaic points (Bungart 1994). However, as a direct result of paleoflood research sponsored by GCES (Ely et al. 1991; O'Connor et al. 1994), the first unequivocal evidence of a Late Archaic campsite within the Grand Canyon river corridor came to light. Charcoal from hearths buried up to 2 m below the surface, located under a shallow rockshelter in upper Marble Canyon, produced a series of radiocarbon dates, the earliest one being 3915 ± 85 B.P. (2508–2289 cal B.C.) (O'Connor et al. 1994:5). Two hundred miles downstream, Hereford et al. (2000a) obtained uncalibrated radiocarbon dates ranging between 2870 ± 60 B.P. (1260–1240 cal B.C. or 1220–910 cal B.C., calibrated at 2 sigma) and 2670 ± 140 B.P. (1210–1190 cal B.C. or 1160–410 cal B.C., calibrated at 2 sigma) on wood charcoal associated with lithic debitage (Figure 47). These findings lend support to the hypothesis that Late Archaic people resided within the inner canyon, at least on an occasional basis, in addition to carrying out rituals with figurines in Redwall caves.

The Preformative Period (ca. 1000 B.C.–A.D. 400)

The timing and processes associated with the introduction of horticulture to the Colorado Plateau is a subject of intense interest and continuing debate among archaeologists working in the region today. This crucial period in southwestern prehistory is currently referred to by a variety of names, including early Agricultural period (Geib 1996; Huckell 1996), Basketmaker II (Matson 1991; McGregor 1967), Terminal Archaic (Schroedl 1976, 1992), and Preformative (Altschul

Figure 47. The Arroyo Grande site, AZ G:3:64, where calibrated radiocarbon dates ranging from 1220 to 410 B.C. are associated with lithic debitage (photograph by Richard Hereford).

and Fairley 1989); Geib, Fairley, and Ambler 1986; Tipps et al. 1996). The first two terms include inescapable implications about the dominant modes of subsistence practiced during this time period. The term Basketmaker II also implies a direct cultural affiliation with ancestral Puebloan cultures (Anasazi). In the Grand Canyon region, we have little direct evidence with which to make solid inferences about the dominant modes of subsistence or specific cultural affiliations of people inhabiting the canyon from about 1000 B.C. to A.D. 400. Therefore, the most neutral label, Preformative, has been chosen to designate the crucial period after cultigens had been introduced on the Colorado Plateau but prior to the introduction of ceramic technology and semisedentism.

Jones and Euler (1979:3) believed there was an occupational hiatus in the Grand Canyon between ca. 1000 B.C. and A.D. 500 that separated the Late Archaic figurine makers from later Puebloan and Cohonina farmers. At the time they hypothesized this 1,500-year hiatus, evidence for use of the canyon during this crucial time period was entirely lacking. Since then, a suite of radiocarbon dates has been recovered from hearths buried in alluvium along the Colorado River that clearly demonstrate a human presence below the rim during this time (Fairley 1992; Fairley and Hereford 2002). However, except for one controversial claim (see discussion below), no cultigens or culturally diagnostic artifacts have been found in direct association with Preformative wood-charcoal dates. Therefore, the cultural affiliations of the people who created the hearths and the nature of their subsistence practices remain uncertain.

Before discussing controversial evidence for early agriculture in the Grand Canyon, a brief overview of the issues surrounding the introduction of agriculture on the Colorado Plateau is necessary. At least three basic models have been proposed to account for the introduction of cultigens to the plateau: (1) a migration of southern farmers (Berry 1982; Berry and Berry 1986), (2) a diffusion of cultigens and associated horticultural techniques to indigenous hunter-gatherer populations (Irwin-Williams 1973, 1979; Morris and Burgh 1954), and (3) a combination of the first two models (Matson 1991). Each of these models invokes a variety of cultural and environmental factors to account for the shift from a hunter-gatherer economy to one based primarily on horticulture. Factors such as indigenous population growth, regional population movements, and genetic changes in crops (which allowed them to be grown successfully in higher, drier environments) have been hypothesized to explain this major subsistence shift and its associated implications of increasing sedentism, increasing social complexity, and community ritual developments.

The timing of the initial introduction and spread of cultigens is crucial to understanding the processes and factors responsible for subsequent cultural changes observed in the archaeological record. As noted by Smiley (1994:165), "the precision and accuracy of the radiocarbon record remains central to the development of testable ideas about the nature of the early agricultural period." Because this issue of timing is so critical, Geib (1996), Matson (1991), Smiley (1994), and others argue that direct dates on cultigens or on directly associated annual plants (i.e., grass pads, basketry) from well-documented, undisturbed contexts should be the standard for advancing claims related to the introduction of agricultural in the Southwest. Based on Smiley's (1994, 2002) latest radiocarbon dates on corn from Three Fir Shelter on Black Mesa and Gilpin's (1994) early corn dates from Lukachukai and Salina Springs, most archaeologists agree that cultigens must have been present on the southern Colorado Plateau by about 1000 B.C. On the northern Colorado Plateau, however, the earliest corn dates cluster around 200 B.C., almost a millennium later (Schroedl and Coulam 1994). The reasons behind the apparent lag in diffusion of agricultural technology to the northern Plateau remain unknown and are a subject of continuing discussion.

Fairley (1989a:107–112) summarized the available evidence up through the mid-1980s for Basketmaker II presence north of the Colorado River. Within the past decade and a half, Matson has developed a strong argument for the presence of a true ("proto-Anasazi") Basketmaker II cultural horizon in the region north of the river and extending as far west as Moapa Valley (Matson 1991). To the south of the Grand Canyon, little progress has been made since the late 1950s in determining cultural origins or other aspects of the earliest preceramic farming cultures on the southwestern corner of the Colorado Plateau. Considerably more attention has been paid to the issue of Basketmaker II occupations east of the Grand Canyon, especially in Glen Canyon (Geib 1996), Black Mesa (Smiley 1994), and the Lukachukai Mountains (Gilpin 1994).

Within the Grand Canyon, evidence for use of the river corridor between 1500 B.C. and A.D. 500 consists of several radiocarbon dates from buried contexts in the Striped Alluvium. Two dates from different cultural contexts fall clearly within the Late Archaic period, approximately 4,500 years ago (Davis et al. 2000:793; O'Connor et al. 1994). Several radiocarbon dates fall near the beginning of the Basketmaker II time period between 3200 and 2700 B.P. (Davis et al. 2000; Hereford et. al. 2000a; O'Connor et al. 1994), and there are clusters of dates ranging between 400 cal B.C. and cal A.D. 400 (approximately 2200–1700 B.P.) in both the western and eastern portions of the inner canyon (Fairley and Hereford 2002; Hereford et al. 1993:11, 2000a). The radiocarbon dates are derived from wood charcoal, and, therefore, the "old wood" factor must be considered in their evaluation. (See Chapter 6 for a more in-depth discussion of this issue.) Even taking this factor into account, a substantial number of radiocarbon dates clearly fall within the Basketmaker II time frame (Smiley 1994), indicating considerable use of the inner canyon during this crucial transitional period (Fairley 1992).

Although the association of these dates with the Basketmaker II period appears solid, the cultural affiliation of the hearths and their associated deposits has not been established (Fairley and Hereford 2002:44–45). An a priori identification of the "younger" hearth sites in the Striped Alluvium—particularly those dating prior to A.D. 1 (ca. 2000 B.P.)—as Basketmaker II presupposes that horticulture was being practiced in or immediately adjacent to the canyon at this early date (Figure 48). So far, the evidence for maize horticulture—a key, defining attribute of Basketmaker II culture—is limited to pollen bounded by radiocarbon dates on unidentified organic material from the vicinity of Comanche Creek (Davis et al. 2000).

Davis et al. (2000:795) claim corn agriculture was being practiced in the Grand Canyon by 1300 B.C., based on the presence of corn pollen bracketed by radiocarbon dates ranging between 3160 ± 60 B.P. (1440–1320 cal B.C.) and 4460 ± 50 B.P. (3300–3030 cal B.C.). There are many methodological problems associated with this claim that argue against its uncritical acceptance. First, the dates came from unidentified charred plant remains located stratigraphically above and below alluvium containing corn pollen. The burnt plants were assumed to be field stubble, but the burnt material was never analyzed or identified. It is possible that the burnt layers represent burnt mesquite *bosques* or driftwood, and the dates could therefore be hundreds of years older than the associated pollen. Second, corn pollen is highly mobile and can filter down into sandy soil from sources higher up in the section, so even if the bracketing dates are accurate, there is no way to know if the corn pollen was deposited in situ, or if it was derived from corn fields located higher up in

Figure 48. An eroding slab-lined hearth (AZ C:13:324) near Tanner Wash. This feature was destroyed by human impacts and dune deflation. Nearby hearths at a similar stratigraphic level produced uncalibrated radiocarbon ages of 1810 ± 60 and 2170 ± 70 B.P. on wood charcoal (photograph by Helen Fairley).

the deposits or perhaps even fields located many miles upstream in Glen Canyon. Finally, the dates and corn pollen were obtained from an alluvial context, where reworking of sediments by prehistoric flood events could have produced spurious associations.

Because corn pollen is notoriously mobile in an active environment such as the Colorado River corridor, it does not satisfy the stringent criteria required for demonstrating the presence of agriculture at this early date (Phil Geib and R. G. Matson, personal communication 2001). Contrary to the claims of Davis et al. (2000:795), the evidence from Comanche Creek (Figure 49), although certainly intriguing, is not adequate for establishing that corn horticulture was being practiced in the river corridor as early as 1300 B.C. Currently, there are no direct dates on corn from any contexts within the Grand Canyon. Charred kernels or other maize parts recovered through the flotation of hearth contents, direct dating of corn recovered from in situ burnt strata within the Striped Alluvium, or both, is the type of evidence necessary to demonstrate unequivocally that corn was being cultivated in the canyon prior to 1000 B.C.

If, as some archaeologists today believe, horticulture was introduced to the Colorado Plateau by a population of farmers moving up from southern Arizona (Berry and Berry 1986; Matson 1991), perhaps via the Gila and lower Colorado Rivers, then it seems likely that the Grand Canyon would have been a focus for early farming on the plateau. This is based on the assumption that migrant farmers would have sought out familiar environments for planting crops—that is, low-lying, alluviated desert river bottoms. On the Colorado Plateau, alluvial bottomlands along the Colorado River within the Grand Canyon offered the requisite features desired by early desert farmers: an aggrading floodplain next to a perennial river in a low-elevation, warm desert environment. Clearly, further research on the age and extent of agricultural activities within the Grand Canyon is warranted.

There are many other intriguing questions related to the Preformative period in the Grand Canyon that could be addressed through careful study and analysis of archaeological remains dating to this critical time period. For example, if corn was being grown in the Grand Canyon by 1000 B.C., who were the cultural antecedents

Figure 49. An overview of the Comanche Creek area in the eastern Grand Canyon (photograph by Richard Hereford).

of these earliest farmers? Jones's identification of a San Pedro point from a deeply buried context near Whitmore Wash, dating to approximately 1135 B.C. (Jones 1986:51), offers an intriguing potential link with contemporary cultural manifestations in southern Arizona.

Perhaps just as intriguing is the question of who these earliest agriculturists may have evolved into. On the southern Colorado Plateau, it is common practice to equate the earliest preceramic agriculturists with Basketmaker II, yet the use of this label implies a direct cultural affiliation with later Puebloan groups on the Plateau. In the western Grand Canyon and in northwestern Arizona south of the Colorado River, archaeologists have identified a purportedly non-Puebloan culture, known as the Cohonina, that superceded indigenous Archaic hunter-gatherers in this area (Jennings 1971; McGregor 1951). What relationship existed between Baskermaker II farmers and the earliest Cohonina, if any? Is it possible that the Cohonina evolved from the same preceramic foundation as their contemporary neighbors living farther to the east? If so, how do we recognize these genetic relationships in the archaeological record? The Grand Canyon river corridor offers a unique opportunity to reengage archaeologists in this discussion and perhaps redefine the parameters on this long-standing debate.

By any measure, the transformation from a hunting-and-gathering (Archaic) economy to one based on (corn) horticulture is a crucial transition in human cultural evolution worldwide. Because the Grand Canyon is known to contain numerous sites dating within the time frame associated with this transition on the Colorado Plateau, the preservation and further study of buried sites in the river corridor is definitely warranted. These sites are important not only for understanding the timing and processes underlying this critical cultural transformation, but they may also be crucial to unraveling the regional story of cultural developments within the Colorado Plateau. It is noteworthy that all of the Grand Canyon sites dating to this period have been found buried in alluvial or aeolian contexts, and virtually all have been discovered as a result of geomorphic research, rather than through archaeological studies. The circumstances of their locations and discoveries underscore the importance of preserving—and conducting further research on—alluvial deposits in the Grand Canyon.

The Formative Period (ca. A.D. 400–1250)

As originally defined by Willey and Phillips (1958:146), the Formative period in North America is characterized by "the presence of agriculture, or any other economy of comparable effectiveness, and by the successful integration of such an economy into a well-established, sedentary village life." Although archaeologists still debate the extent to which Puebloan farmers and their immediate neighbors practiced sedentary agriculture and relied on cultivated foods, it is quite apparent from the archaeological record in northern Arizona that horticulture has been an important and integral aspect of the region's Native American economy since at least A.D. 1. This is reflected in the ubiquity of cultivated-plant remains and cultigen pollen found in refuse middens, constructed storage contexts, and human feces, in addition to the results of bone-chemistry analyses (e.g., Chisholm and Matson 1994). Settlement strategies, whether involving seasonally occupied structures or year-round habitations, also reflect this orientation.

In the Grand Canyon, the degree to which Formative populations lived a sedentary, horticulturally dependent lifestyle is a matter of continuing debate (e.g., Sullivan 1987, 1992, 1995a, 1995b; Sullivan et al. 2002). Nevertheless, in the Grand Canyon region, this term is used to refer to that time period during which most of the southern Colorado Plateau was occupied by small communities of people who lived in substantially constructed dwellings, tended gardens of cultivars such as corn and squash, and produced ceramics. For convenience, the Formative period is divided into Early (A.D. 400–1000) and Late (A.D. 1000–1250) periods. This division reflects the differences in current information levels, as well as apparent differences in the complexities and patterning of the archaeological evidence during the Early and Late Formative.

In the "traditional" interpretation of the Formative period at the Grand Canyon (e.g., Euler 1967a, 1969a, 1981a; Jones and Euler 1979), Puebloan farmers entered the canyon ca. A.D. 700–800 (Effland et al. 1981:13; Euler 1967a:24, 27). During the subsequent three centuries, their numbers gradually increased (Effland et al. 1981:13). Around A.D. 900–1000, people affiliated with the Kayenta region expanded into the Grand Canyon, which swelled the number of sites dating to the eleventh and early twelfth centuries (A.D. 1000–1150). The time period, commonly known as Pueblo II, corresponds to the pinnacle of Puebloan (Anasazi) cultural expression in the Grand Canyon. Shortly after the mid-1100s, the population of the area plummeted. By A.D. 1200 (and no later than A.D. 1220, according to Jones [1986:324]), the Puebloan people left the Grand Canyon, presumably moving to the south, east, or both.

Almost as an aside, these "traditional" accounts note that there were other cultural groups, contemporaries of the Kayenta, who occupied the western reaches of the canyon during the Formative period. To the north of the river were the Virgin Anasazi, and to the south were the Cohonina. According to Euler (1967a:26; 1981a), the Cohonina made their first appearance in the Grand Canyon at about the same time that the Kayentans were moving in from the east, ca. A.D. 700. According to Euler's model (still espoused by most Grand Canyon archaeologists), these groups lived peacefully side by side for several centuries, up until ca. A.D. 1100–1150, when the Cohonina inexplicably vanished from the archaeological record, perhaps having been subsumed by flourishing twelfth-century Puebloan communities.

Euler et al. (1979) point to deteriorating climatic conditions as the primary cause for the depopulation of the Grand Canyon in the middle of the twelfth century. Shortly thereafter (sometime between A.D. 1150 and 1300), ancestors of the Hualapai and Havasupai moved onto the Colorado Plateau and into the southwestern reaches of the Grand Canyon, reoccupying the same territory formerly used by the Cohonina. At about the same time, to the north of the river, ancestors of the Southern Paiute reoccupied the area that had just recently been vacated by Puebloan farmers (Euler 1967a:69).

Despite the popularity of this interpretation, not all archaeologists accept Euler's version of Formative prehistory in the Grand Canyon. One archaeologist who had a decidedly different interpretation of the prehistoric culture history of the region was Douglas Schwartz (1955, 1956, 1966a). Having come to the Grand Canyon by way of excavations in the Cohonina "heartland" near Ashfork, Red Lake, and Tusayan, Schwartz viewed the Cohonina culture not as a peripheral culture, but as a key player in Grand Canyon prehistory. Schwartz maintained that the Cohonina had lived in the Grand Canyon for much longer than the Puebloan people, perhaps having developed out of an indigenous Archaic base (McGregor 1951). In the Grand Canyon, he placed their initial appearance ca. A.D. 600, but acknowledged that this reflected archaeologists' reliance on ceramics to recognize this culture in the archaeological record. Furthermore, and most controversial of all, Schwartz argued that the Cohonina never left the Grand Canyon region, but instead retreated to Havasu Canyon in the 1200s and developed over time into the people we call the Havasupai today (Schwartz 1955, 1956, 1957, 1958).

A major problem with both Euler's and Schwartz's interpretations of Grand Canyon culture history is that neither scholar ever acquired the kind of evidence needed to support or refute their respective positions. Both conducted research in the Grand Canyon with predetermined ideas of what had happened in the past, and both remained stubbornly committed to upholding their respective viewpoints. Thus, even though considerable evidence accumulated over the ensuing 40 years indicating that the Cohonina culture did in fact predate the Puebloan entry into the Grand Canyon (Fairley et al. 1994:104–105), Euler never wavered from his original position or gave any ground to Schwartz's version of past events. More recently, Schwartz has retreated from the claim of cultural continuity between Cohonina and Havasupai (Schwartz 1989:38), but this shift in his long-standing position is not because of the discovery of new evidence supporting Euler's version or refuting his own. Rather, it appears to be a case of Schwartz simply "throwing in the towel" on this long-standing debate. In reality, with a few exceptions discussed below, very little has changed from an evidentiary standpoint since Euler and Schwartz first formulated their respective positions in the late 1950s and refined them in the late 1960s. Our current knowledge of Cohonina prehistory and its relationship to the larger patterns of the culture history of the Southwest remains frustratingly vague and incomplete.

Early Formative Period (A.D. 400–1000)

Using the appearance of ceramic technology sometime around A.D. 400–500 as the beginning point, the Early Formative period covers six centuries of cultural developments, landscape changes, and human interactions across the greater Southwest. This time corresponds to the temporal periods known as Basketmaker III and Pueblo I elsewhere on the southern Colorado Plateau.

In the corner of northern Arizona occupied by the Grand Canyon, the Early Formative period is still relatively unknown and understudied, especially the first three to four centuries equivalent to the Basketmaker III period. In survey situations elsewhere in northern Arizona, this period is typically recognized by the presence of Lino Gray and Lino Black-on-gray ceramics. Assemblages consisting primarily or exclusively of these diagnostic sherd types are extremely rare in the Grand Canyon, limited to fewer than a dozen recorded sites out of approximately 3,500 (Grand Canyon National Park archaeology site files). Sites that have produced calibrated radiocarbon dates falling between A.D. 400 and 800 are just as rare, and when other diagnostic artifacts are present, these dates often appear to be too old relative to the associated archaeological remains. The scarcity of Basketmaker III remains led Effland et al. (1981:13) to state that "[e]xcept for the Split-Twig Figurine Complex, there is no direct evidence of human presence within the Inner Canyon until around A.D. 700 to 800."

As in the Glen Canyon region (Geib 1996:78–80), the apparent paucity of evidence for early Preformative occupation in the Grand Canyon may be a product of archaeologists' reliance on diagnostic Puebloan ceramic types to identify this time period in the archaeological record. If Puebloans were not present in the canyon during Basketmaker III or early Pueblo I times, but other groups were, and if Puebloan ceramics were only sparsely present because of infrequent trade with locally based non-Puebloan residents (i.e., Cohonina), then archaeologists would have difficulty recognizing an occupation during this time period. There are also implicit biases about the ages of non-Puebloan plain gray wares that may be skewing our perceptions about the Early Formative prior to A.D. 800. For example, when a site consists only of Deadmans Gray ceramics rather than Lino Gray, and no decorated wares are present, most archaeologists assume that the site dates to between A.D. 700 and 1100 (Pueblo I–II), because this is the time frame commonly ascribed to the Cohonina occupation in the Grand Canyon. This bias is illustrated by the original temporal assignment of AZ C:13:101 (a site containing cists and a predominance of Deadmans Gray ceramics near Palisades Creek) to the Pueblo I–II period, even though typical Pueblo II diagnostic ceramic types were lacking at the site.

With these caveats in mind, a brief review of the evidence for Basketmaker III and Pueblo I use of the Grand Canyon area is offered here. Reviews of the Basketmaker III and Pueblo I evidence from upland areas adjoining the Grand Canyon are available in Altschul and Fairley (1989) and Cartledge (1986). Starting with the radiocarbon evidence, roughly two dozen calibrated radiocarbon dates between A.D. 200 and 800 have been recovered from various contexts in the Grand Canyon region so far, although not all of them are from unequivocal cultural contexts. With one exception, these dates come from wood charcoal. In several cases, the cultural associations of the dates are ambiguous. One suite of controversial dates was recovered by Dr. Richard Thompson at the Little Jug site from a pit house containing brown plain ware ceramics (Thompson and Thompson 1978). This site produced six uncalibrated radiocarbon dates clustering between 1850 ± 90 and 1630 ± 90 B.P., which Thompson interpreted as evidence of ceramic production during the second or third century A.D. Berry (1982:55), in his exhaustive review of radiocarbon data from early ancestral Puebloan sites, supported Thompson's interpretation; however, Fairley (1989a:112) urged caution in accepting these dates at face value. She argued that at least a couple of hundred years should be added to the Little Jug dates to account for the use of old wood. Even with a 200-year adjustment, this would still place the beginning of ceramic production north of the Grand Canyon perhaps as early as A.D. 400.

Three of the five sites tested by Jones produced early radiocarbon dates that she cautiously interpreted as possibly reflecting Basketmaker III components (Jones 1986:107). None of these sites had Basketmaker III artifacts on the surface, and all of the dates came from buried contexts. At the Tuna Creek site (AZ B:15:7), Jones reported a date of A.D. 245–585 calibrated at 2 sigma from an aceramic midden deposit 55–60 cm below the surface, whereas at Deer Creek (AZ B:10:4), she obtained two dates from a deeply buried roasting feature that ranged from A.D. 230–610 to 380 B.C.–A.D. 210 calibrated at 2 sigma (Jones 1986:105). From the midden at the Beamer's Cabin site (AZ C:13:4) a 2-sigma calibrated date of A.D. 440–795 came from a firepit approximately 1.25 m below the surface. Jones was cautious about ascribing these dates unequivocally to Basketmaker II or III because of uncertainties arising from the old wood problem, but, at the same time, she argued that the stratigraphic and archaeological contexts did not preclude the possibility that these sites had been occupied during this early time period. The Basketmaker III date from AZ C:13:4 was somewhat problematic, however, because it was associated with a deeply buried aceramic horizon containing numerous, small bifacial-thinning flakes, whereas Lino Gray ceramics were present much higher up in the midden profile, overlain by Pueblo I ceramics. Yeatts (1998) was likewise cautious about interpreting two overlapping dates from a roasting pit at AZ C:13:273, ranging between A.D. 575 and 775, as indisputable evidence of Basketmaker III use because of the old wood issue, and also because the San Francisco Mountain Gray Ware ceramics at this site suggested to him a somewhat later date of occupation.

Perhaps the most controversial radiocarbon dates purportedly relating to a Basketmaker III occupation come from the Nankoweap area near River Mile 52. A radiocarbon date of 1420 ± 90 B.P. (cal A.D. 560–580) (Davis et al. 2000:793) on unidentified plant remains from an undescribed buried alluvial context in association with a single grain of cotton pollen was interpreted by Davis et al. (2000:796) as evidence of cotton farming in the Grand Canyon by the sixth century A.D. If correct, this claim would indicate that cotton was being grown in the Grand Canyon 500 years earlier than anywhere else on the Colorado Plateau (cf. Bohrer 1983; Kent 1957:457). The validity of the Nankoweap evidence is questionable on several grounds: (1) there is no identification or description of the dated material or its specific context, (2) the date comes from an alluvial context in which significant reworking of deposits by fluvial action is likely (Richard Hereford, personal communication 2000), and (3) even if the date had come from a primary context, such as a hearth, a date on charcoal could be several centuries earlier than the targeted event.

A more convincing Basketmaker III radiocarbon date is the 1510 ± 50 B.P. (cal A.D. 435–650, calibrated at 2 sigma) date on shadscale charcoal from a slab-lined feature at AZ C:13:10, which was interpreted as evidence of an occupation in the A.D. 500s or 600s (Andrews et al. 1996:100). With this one exception, however, virtually all of the dates that have been cited as possible evidence of Baskermaker III occupation in the canyon are derived from wood charcoal, so the "old wood" issue remains an obstacle to the uncritical acceptance these dates. Currently, there is only one Basketmaker-age radiocarbon date on annual-plant material from the Grand Canyon, a small fragment of a rod from a coiled basket that produced a radiocarbon date of 1535 ± 80 B.P. (Beta-45831, woody plant material, corrected for isotopic fractionation; cal A.D. 340–660, calibrated at 2 sigma with the program CALIB 2.0 [Stuiver and Reimer 1987]) (Grand Canyon National Park archaeology site files). This basket was constructed using the single-rod foundation, noninterlocking stitch technique. A river guide found the artifact on the surface of a rockshelter in Fossil Canyon in 1989 and collected a fragment for dating purposes. Unfortunately, shortly after the date was obtained, the basket disappeared and has never been recovered.

Even though most of the radiocarbon dates that fall squarely within the Baskermaker III time frame are from wood charcoal and, therefore, suspect, other archaeological evidence points to at least sporadic use of the canyon during the earliest part of the Formative period. At least two isolated, plain gray sand-tempered ceramic jars have been found cached in overhangs or along travel routes in the eastern Grand Canyon near the confluence with the Little Colorado River (AZ C:13:281 and AZ C:13:330), suggesting that some level of Puebloan use of the Grand Canyon was definitely occurring between A.D. 400 and 800. Only one of these vessels has the classic coarse, grainy texture of Lino Gray, whereas the other has a smoothed, somewhat bumpy surface more reminiscent of the Basketmaker III type, Obelisk Gray. More substantial sites containing diagnostic plain gray ceramic scatters in association with other artifacts or features are rare, however, which implies that Basketmaker III people were not residing within the canyon on a regular basis at that time.

Alternative explanations for the paucity of Basketmaker III artifacts in the river corridor may be found in the river corridor's alluvial stratigraphy. Hereford et al.'s (1993; Hereford, Thompson, Burke, and Fairley 1996) research on the alluvial stratigraphy of the eastern Grand Canyon indicated an absence of deposits dating to between A.D. 300 and 700. This hiatus in the depositional sequence suggests that if this portion of the archaeological record was ever present, it has since been extensively eroded, presumably by later flood events. An alternative hypothesis is that no significant amount of deposition occurred during this interval. If the latter circumstance is responsible for the depositional hiatus, this might suggest that the centuries between A.D. 300 and 700 were characterized by a regionally dry climatic interval. On the other hand, an exceptionally erosive environment would not have been conducive to settlement by early floodplain agriculturists. Careful analysis of the geomorphic record could potentially shed more light on this important issue.

Turning to the Pueblo I period between A.D. 800 and 1000, the archaeological record is only slightly more robust than the preceding period, due largely to the somewhat greater abundance of diagnostic ceramics and the fact that alluvial deposits dating to this time period are preserved in the river corridor. Diagnostic ceramic types of the Pueblo I period in northern Arizona include Kana-a Neck Banded, Kana-a Black-on-white, Floyd Gray, Floyd Black-on-gray, San Juan Red Ware (Bluff and Deadmans Black-on-red), and Washington Black-on-gray. In the Grand Canyon, these temporally sensitive ceramics are typically found in association with less sensitive San Francisco Mountain Gray Wares (especially Deadmans Gray) south of the river and with North Creek Gray or Moapa Gray north of the river, rather than with Lino Gray. The Kana-a types seem to be relatively rare in the Grand Canyon until sometime after A.D. 900, when they typically occur in association with either San Francisco Mountain Gray Ware or early Pueblo II Kayenta types (Wepo Black-on-white and early styles of Black Mesa Black-on-white). At least one storage cache consisting exclusively of Kana-a Gray Neck Corrugated jars has been located along a travel route within Marble Canyon (George Steck, personal communication 1993).

Based on their work at Unkar Delta, and also on Wheat and Wheat's (1954) excavation of a Pueblo I Cohonina site on the South Rim, Schwartz et al. (1980:85–88) argued that the initial Formative occupants of the eastern Grand Canyon were Cohonina, rather than Puebloan (Anasazi), as maintained by Euler. Out of 52 sites on Unkar Delta, Schwartz identified 2 (UN-8 and UN-52) with buried components predating the extensive Pueblo II occupation of the delta. He assigned these components to the Medicine Valley Focus of the Cohonina culture, ca. A.D. 900, based on the abundance of San Francisco Mountain Gray Ware ceramics at these

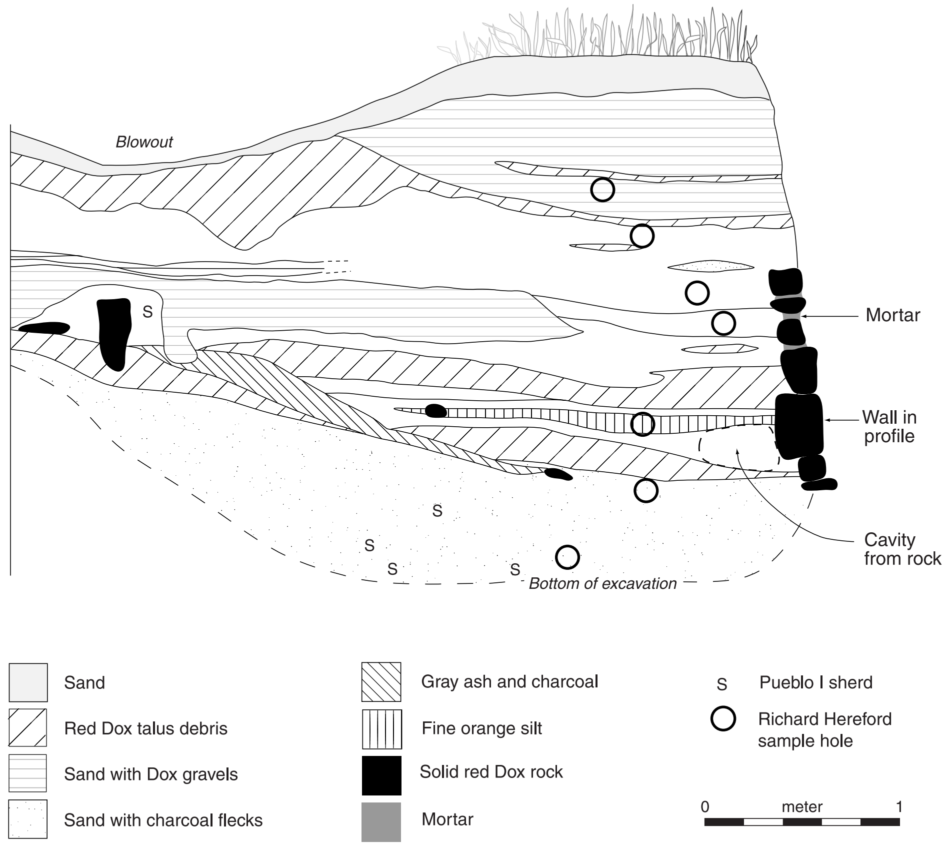

Figure 50. Cross section of an arroyo wall at AZ C:13:10, near Unkar Delta, showing the location of Early Formative ceramic sherds in relation to a later Pueblo II masonry wall.

sites. At UN-52, the Medicine Valley component was identified on the basis of a midden deposit containing San Francisco Mountain Gray Ware that underlay masonry structures. Schwartz could not determine whether these surface structures were associated with the Medicine Valley occupation or postdated it. At UN-8, a shallow pit structure with associated San Francisco Mountain Gray Ware ceramics was found underneath a surface pueblo with a typical middle to late Pueblo II ceramic assemblage. It is also noteworthy that these two sites produced 28 of the 30 Kana-a Black-on-white sherds recovered at Unkar Delta. From this meager evidence, Schwartz concluded that a small number of Cohonina lived on and probably farmed the delta prior to the arrival of Kayenta-affiliated farmers in the middle A.D. 1000s.

During his helicopter and raft reconnaissance trips through the inner canyon, Euler located very few sites with ceramics dating prior to A.D. 1000. One site with Pueblo I ceramics (Kana-a Black-on-white) was first located by Taylor (1958) across from Deer Creek Falls (AZ B:10:4), and another, AZ C:13:10, was found by Euler and Taylor (1966) upstream of Unkar Delta. Both of these sites were subsequently tested by Jones in 1984. In both cases, Pueblo II structures overlay and obscured older cultural deposits. At the Deer Creek site, Jones did not explicitly identify a Pueblo I occupation, although she documented a roasting pit underlying a late Pueblo II structure that produced radiocarbon dates ranging between 380 cal B.C. and cal A.D. 610. Jones also did not explore the Pueblo I occupation at the Furnace Flats site (AZ C:13:10), although she noted the presence of a few ceramic types dating to this time period. Five years later, in conjunction with Hereford et al.'s (1991) pilot geomorphology project, Balsom and Fairley uncovered Deadmans Gray, San Juan Red Ware, and Floyd Black-on-gray ceramics in a buried alluvial context exposed in an arroyo wall at AZ C:13:10, approximately 1.5 m below the level containing Pueblo II structures (Figure 50). This area had not been tested by Jones and her crew in 1984. As mentioned above, in 1996, a slab-lined feature in the same general area, but at a slightly lower elevation, was excavated by Grand Canyon National Park archaeologists to mitigate potential adverse impacts from a controlled experimental flood (Balsom and Larralde 1996). The hearth produced a radiocarbon date of 1510 ± 50 B.P. (cal A.D. 435–650, calibrated at 2 sigma) on shadscale charcoal, which the archaeologists interpreted as evidence of an occupation in the A.D. 500s or 600s (Andrews et al. 1996:100).

Outside of the river corridor, Sullivan and his students have recorded numerous Cohonina sites in the Upper Basin, on the South Rim east of Desert View (Sullivan 1986, 1992, 1995a, 1995b, 1996, 1997; Sullivan et al. 1994, 2002). Based on spatially controlled analyses of artifact distributions, Sullivan (1986:326) concluded that the Cohonina and Anasazi employed different subsistence strategies, and that Cohonina use of the area predated that of the Anasazi, although there appears to have been considerable overlap after A.D. 1050. Sullivan (1986:330) suggests that the Cohonina can be characterized as "semi-sedentary collectors" who employed a four-tiered settlement strategy to exploit wild resources located at considerable distances from their home villages. The settlement system was composed of "perennial villages" (i.e., concentrated clusters of pit houses, such as those located near Sitgreaves Mountain [Samples 1992]); isolated single-family habitations, such GC 505 near Tusayan Ruin (Wheat and Wheat 1954); seasonally occupied camps; and tool-refurbishing or food-processing stations. Sullivan initially found no evidence for perennial village settlement within the Upper Basin, implying that Cohonina exploitation of Upper Basin resources was exclusively seasonal. In 2002, however, a large Cohonina structural site was located (Alan P. Sullivan III, personal communication 2002), suggesting that this original assessment will need to be revisited.

As a result of the comprehensive inventory survey conducted within the river corridor during the 1990s, as well as later geoarchaeological studies, several additional sites and site components dating to the Pueblo I period came to light. Most Pueblo I remains in the river corridor have been found in subsurface contexts or have been identified from temporally mixed surface assemblages. Five sites were assigned exclusively to the Pueblo I period, and another 27 contained datable ceramics that overlapped with the A.D. 800–1000 period (Samples 1994:32). Most of these sites are in buried or deflated contexts within the "Alluvium of Pueblo II Age" mapped by Hereford et al. (1993). For example, a stratigraphic situation very similar to the one at AZ C:13:10 was uncovered in the Palisades area at AZ C:13:99 (Hereford et al. 1991). A Pueblo I (Coconino Focus) ceramic assemblage composed of San Francisco Mountain Gray Ware (Floyd Gray and Floyd Black-on-gray) was exposed in an arroyo cross section, stratigraphically underlying an early to middle Pueblo II ceramic assemblage that included Black Mesa Black-on-White, Medicine Black-on-Red, and Tusayan (or Coconino) Corrugated. Also, as previously noted, Euler had earlier found a surface site (AZ C:13:101) with a similar ceramic assemblage dominated by San Francisco Mountain Gray Ware in a deflated dune context a couple of hundred yards south of AZ C:13:99, although he assigned this site to a generalized Pueblo I–II time period. This latter site, with its storage cists, appears to fit Sullivan's second-tier settlement type.

With the exception of UN-8 and possibly UN-52, both excavated by Schwartz at Unkar Delta, none of the Early Formative sites in the canyon has constructed features other than slab-lined cists, hearths, and roasting pits. Although it is tempting to point to this lack of substantial structures as evidence that the Cohonina used the canyon less intensively than subsequent occupants, this apparent pattern may not hold up in the long run, because only the sites at Unkar Delta have been excavated to an extent that approaches full data recovery. More detailed study of the subsurface deposits in the Palisades and Unkar areas could reveal the presence of additional buried features, possibly including pit structures, dating to the Early Formative period.

Late Formative Period (A.D. 1000–1250)

The Late Formative period is the most extensively studied and celebrated period of Grand Canyon prehistory, in large measure because of the widespread abundance and highly visible evidence of Pueblo II masonry habitations, granaries, field systems, and distinctive decorated ceramics. When visitors to the Grand Canyon are introduced to the region's prehistory, it is usually by way of the largest excavated ruins in the area, such as Tusayan Pueblo on the South Rim or Walhalla Pueblo on the North Rim, both of which date to the latter part of this period. Since most archaeological investigations in the Grand Canyon have involved surface surveys rather than excavation, the Late Formative Puebloan occupation has garnered the most attention from archaeologists (e.g., Effland et al. 1981; Euler 1967b; Euler and Chandler 1978; Euler and Taylor 1966; Hall 1942; Schwartz 1965; Schwartz et al. 1979, 1980, 1981; West 1925). Despite this long-standing interest, however, many aspects of the Pueblo II occupation in the Grand Canyon remain unstudied and unknown.

We know, for example, that sites with Cohonina pottery dominate Pueblo II ceramic assemblages on the South Rim west of the Grand Canyon Village area, whereas Pueblo II sites with Kayenta pottery predominate in areas to the east (Figure 51), but the process by which this arrangement came into existence or the nature of the relationship between these two contemporaneous groups remains a complete mystery. Likewise, the subsistence strategies employed by these two cultural entities are the subject of continuing debate among archaeologists, even though the arguments are based on very little substantial evidence.

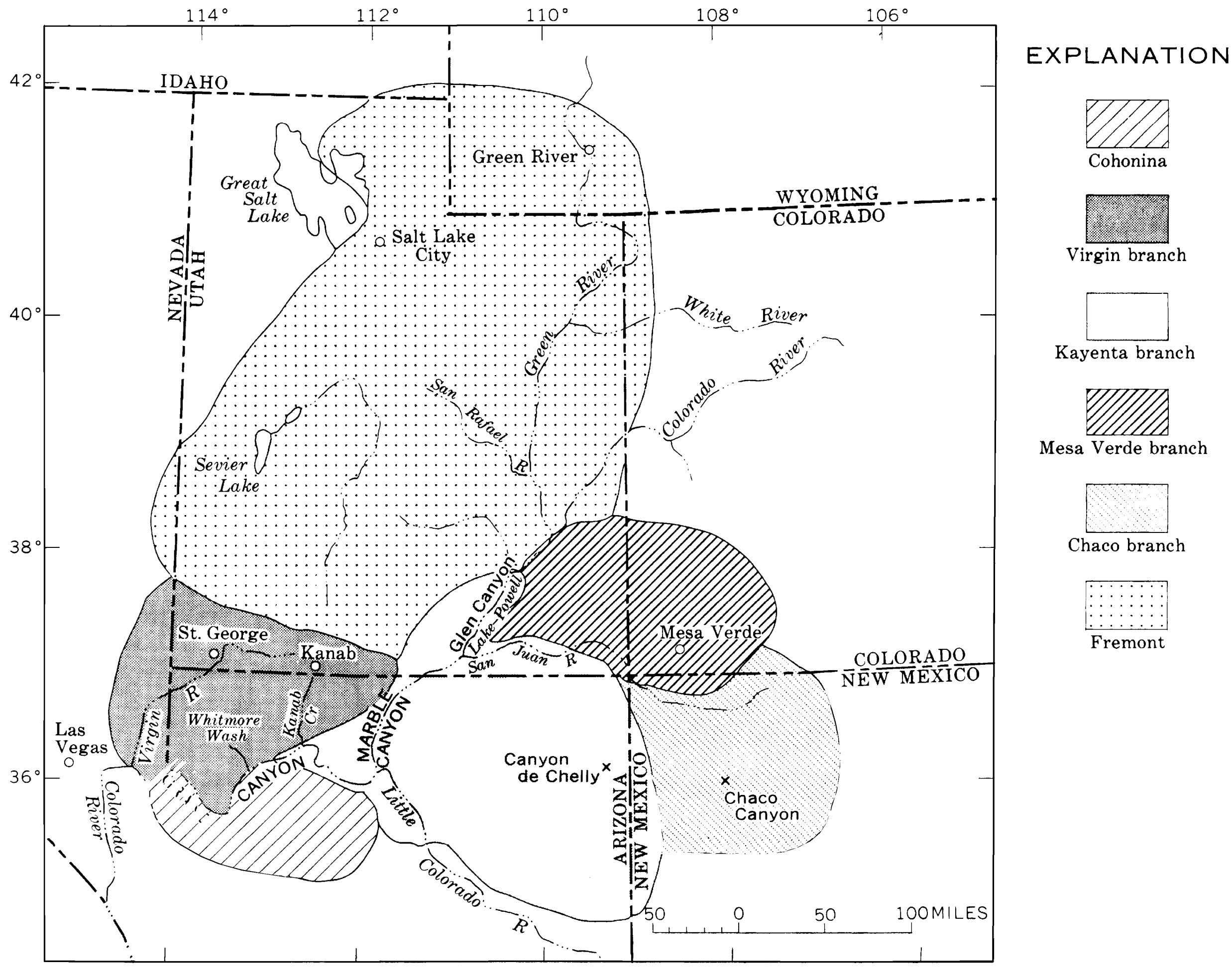

Figure 51. Associated archaeological cultures in the Grand Canyon area and Colorado Plateau at approximately A.D. 1000.

For example, the ongoing debate over the extent to which Cohonina and Anasazi practiced farming over wild-food collecting (e.g., Cartledge 1979; Samples 1992; Sullivan 1986) cannot be addressed with the current evidence. Schwartz (1989:35–38) believes the material evidence of pottery, architecture, cultivated-plant remains, terraces, and checkdams indicates that the Cohonina had a farming-dependent lifestyle. Cartledge (1979) relied primarily on survey evidence to argue for a Cohonina culture that was seasonally focused on cultivation, whereas Sullivan (1986, 1995a, 1995b) used a limited amount of excavation data, in conjunction with survey evidence from the Upper Basin, to argue that the Cohonina were not farmers at all (Sullivan 1986:331) or were casual farmers at best (Sullivan 1995a:60–61).

Even more perplexing is the range of subsistence strategies ascribed to the Puebloan occupants of the Grand Canyon. Schwartz (1966a) proposed that Puebloan farmers occupied and farmed the alluvial fans of the inner canyon on a year-round basis, although after A.D. 1050, summer farmsteads were also established on the Walhalla Plateau, which allowed the prehistoric farmers to pursue a multiple cropping strategy. Effland et al. (1981:43), on the other hand, argued that on the Powell Plateau, seasonal movements were largely confined to the plateau itself. The size and configuration of the sites on the Powell Plateau implied a more permanent occupation than that of the Walhalla Plateau. Furthermore, the authors speculated that seasonal movements between the inner canyon and the Powell Plateau focused on the exploitation of seasonally available wild resources, although some farming may also have occurred in the well-watered canyons at lower elevations. For the western South Rim, Euler (1976; Euler and Green 1978) argued for a winter-upland, summer-lowland settlement-subsistence system similar to the traditional Havasupai lifeway. This subsistence system presumably relied on a combination of hunting, gathering, and farming, followed by a spring agave harvest on the inner-canyon benchlands. This preceded summer farming in the canyon bottoms, followed by movement up to the South Rim during the fall to gather pinyon nuts, hunt deer and rabbits, and prepare for winter in the dense woodlands away from the canyon rim.

In contrast, Sullivan (1986:330) characterizes the Kayentan occupants of the Upper Basin (the eastern South Rim) as “settled horticultural foragers” with a three-tiered settlement system composed of permanent habitations, repeatedly reused (presumably seasonally occupied) farmsteads, and briefly occupied “work areas,” all of which occur in the same environmental zone and in relatively close proximity to one another. Furthermore, because of the paucity of cultigen pollen and macrobotanical evidence recovered from excavated habitation sites in the Upper Basin, Sullivan (1986, 1987, 1996) argues that agriculture played a relatively inconsequential role in this system, whereas wild foods, especially pinyon nuts (Sullivan 1992, 1996), formed the bulk of the Puebloans’ diet. Sullivan’s “settled forager” model has been criticized by other archaeologists working in the Grand Canyon area because it relies on a limited amount of excavation and survey data from a restricted area to characterize the Puebloan occupation of the Grand Canyon as a whole, all the while ignoring the archaeological evidence from the inner canyon and North Rim. Recently, Sullivan et al. (2002) responded to these criticisms by introducing a “cross-canyon model.” This model proposes that Puebloan foragers resided permanently in the Upper Basin, where they provisioned themselves primarily with wild resources, and seasonally moved across the river to the North Rim to pursue hunting, gathering, and limited agriculture. According to this model, inner-canyon settlements, such as the one at Unkar Delta, represented a localized extension of the Upper Basin winter-fall habitation pattern.

Another settlement-subsistence model that could account for the lack of cultivated remains in Upper Basin habitation sites is one in which Puebloan farmers resided and farmed in the canyon bottoms, maintained summer farmsteads on the Walhalla Plateau, and also made seasonal use of the Upper Basin for pinyon-nut harvesting, deer hunting, and the procurement of other wild resources in the autumn months.

In any case, it seems likely that no single settlement-subsistence strategy prevailed throughout the Grand Canyon during the Late Formative. The variabilty in the elevation of the rims and the changing topography of the inner canyon as one moves downstream render some settlement strategies more practical for specific areas of the Grand Canyon than for others. For example, in the eastern canyon, where the bottomlands along the river and the inner valleys paralleling the Butte Fault are relatively broad and open, year-round habitation would be feasible. Conversely, because the North Rim rises to an elevation above 8,000 feet in this section, year-round occupation of the North Rim would be untenable, although the higher precipitation levels and cooler summer temperatures would have been conducive to growing specific crops, such as beans. In the eastern canyon region, therefore, a winter-spring-lowland, summer-upland strategy is plausible. As one moves westward, the inner canyon becomes narrower and very shady in the winter, and alluviated areas are essentially absent from the river corridor, although they can be found in some of the perennial side canyons draining the North Rim. In this central part of the canyon, year-round habitation of the inner canyon would not have been desirable, except perhaps in the well-watered side canyons, and even these locations would have been subject to cold-air drainage in the winter months. Hence, year-round occupation at higher elevations with seasonal farming in the canyon bottoms makes the most sense. Farther west, the canyon rim drops in elevation, and the areas back from the rim contain open alluvial valleys bounded by pinyon-juniper-wooded ridges. The canyon below Lava Falls widens out and contains some broad expanses of alluvium in places; however, summers are extremely hot in this reach. Thus, in the western Grand Canyon, year-round habitation of the canyon rims, including farming in the alluviated upland valleys, and seasonal (late-winter–spring) exploitation of the inner canyon may have been the prevailing settlement-subsistence pattern. Although the archaeological survey data and limited excavation data from the Grand Canyon seem to support these ideas, much more work is needed to verify them.

Missing from most summaries of the Late Formative period in the Grand Canyon are discussions of the factors and processes responsible for the regional dispersal of Puebloan farmers during this time period and the nature of relationships between preexisting populations and immigrant groups after A.D. 1000. The issue of relationships presupposes that Puebloan immigrants from the Kayenta region were responsible for the noticeable expansion in site numbers both north and south of the canyon after A.D. 950–1000. (It also presupposes that ceramic distributions are indicative of population movements, an issue that will be addressed in greater detail in Chapter 6.)

Euler (1969b, 1974; Effland et al. 1981) proposed that Kayentan people began using the canyon intermittently or seasonally as early as A.D. 700. Sometime between A.D. 900 and 1000, they began residing more permanently in the eastern area of the South Rim and perhaps within the eastern section of the inner canyon as well. The vast majority of Puebloan sites postdate A.D. 1050, however, and most Puebloan sites in and around the canyon were established in the period between A.D. 1050 and 1100. By A.D. 1150 (Figures 52–54), the majority of the Puebloan sites had been abandoned, and by A.D. 1200 (perhaps as late as A.D. 1220 [Jones 1986:324]), the Puebloan occupation of the Grand Canyon had ended. Although Puebloan people continued to visit shrines, trade with their western neighbors, and extract minerals and other resources for centuries thereafter, they no longer resided in the canyon after that time.

Euler (1974; Euler et al. 1979) and others (e.g., Coder 2000; Effland et al. 1981) have attributed the Pueblo II expansion and subsequent depopulation entirely to climatic factors. Tree-ring records indicate that favorable climatic conditions, in the form of increased moisture and reduced year-to-year variability, prevailed during the late A.D. 1000s and early 1100s throughout northern Arizona (Dean 1988; Euler et al. 1979). The tree-ring record also indicates that a severe drought of several years duration occurred around A.D. 1170, and for several decades thereafter, the tree-ring record shows a period of increased variability. According to Euler et al. (1979), this combination of drought and increased variability caused the Puebloan populations to coalesce into the most productive areas.

Fairley has argued (1989a:137–138, 1997a; Fairley et al. 1994) that climate alone may not have been responsible for the Puebloan expansion into the Grand Canyon during the middle A.D. 1000s. She hypothesizes that the desire to grow cotton on the Colorado Plateau during the eleventh century A.D. may have prompted Puebloan farmers to seek out those environments that offered the necessary attributes for successful cotton production—that is, abundant water, warm temperatures, and an extended growing season. Prior to this time, finished cotton textiles are found in Puebloan sites, but evidence of in situ cotton production in the form of seeds, unprocessed fibers, and plant parts is absent from the plateau (Bohrer 1983; Kent 1957:467). Beginning ca. A.D. 1050, however, cotton seeds, bolls, and fibers appeared in the Glen Canyon region in considerable quantity (Cutler 1966). Within the Grand Canyon, a granary near Unkar Delta produced cotton boll fragments (Cutler and Blake 1980:211), and recently, a cotton pollen grain was identified in alluvium near the mouth of Nankoweap Creek (Davis et al. 2000). Whether cotton production was the impetus remains to be determined, but, in any case, it is clear that the expansion of Puebloan occupation into the low-lying canyons of the Colorado Plateau was not restricted to the Grand Canyon but included neighboring Glen Canyon as well (Ambler et al. 1983; Geib 1996:182).

As far as the depopulation of the region is concerned, another possible explanation involves competition and aggression from Southern Paiutes moving into the region from the northwest. Once again, there is considerable debate among archaeologists concerning the viability of this hypothesis (e.g., Ambler and Sutton 1988; Lyneis 1994; Madsen 1975; see Madsen and Rhode [1994] and

Figure 52. A Pueblo II structure at AZ C:13:10, near Unkar Delta, partially covered by drifting aeolian sand (photograph by Helen Fairley).

Figure 53. AZ C:13:349, a buried multicomponent site, near Tanner Wash in the eastern Grand Canyon. A geomorphologist is examining a trough metate emerging from the arroyo wall. The metate is associated with a mid–Pueblo II cultural deposit overlain by Colorado River flood sand (photograph by Richard Hereford).

Fairley [1989a] for a discussion of the evidence, pro and con). Euler (1964:379), once a proponent of the idea, later dismissed it because he could find no evidence of contemporaneity in Late Formative and Southern Paiute archaeological manifestations. Recently, Lyneis (1994) revisited the evidence for contemporaneity of materials in southern Nevada and concluded that the previously reported associations were unsupportable.

Up to this point, we have restricted discussion of Grand Canyon culture history to models and explanations derived by archaeologists from the physical evidence of past human activities. Hopi cultural scholars, however, offer another explanation for the widespread distribution of Puebloan sites in the

Figure 54. AZ C:9:1, a prominent Pueblo II ruin, near the mouth of Nankoweap Creek (photograph by Helen Fairley).

Grand Canyon, that has nothing to do with climate or farming requirements per se. Instead, according to traditional Hopi views, it was the spiritual destiny of specific clans to travel through this area and leave their footprints at stopping places along the way. While completing these predestined journeys, they received the wisdom and learned the ceremonies that ultimately gave them the right to eventually settle on the Hopi Mesas and become the Hopi Tribe we know today. Their departure from the Grand Canyon was not forced by environmental degradation or warfare with neighboring tribes, but rather reflected their preordained destiny to continue traveling until they found their final destination, the Hopi Mesas.

Late Prehistoric/Protohistoric Period (A.D. 1250–1776)

After the ancestral Puebloan people ceased to occupy the Grand Canyon region on a year-round basis, sites affiliated with ancestral Pai and Southern Paiute dominate the archaeological record for the next 600 years. These sites are generally identified by the presence of brown ware pottery (Tizon Brown Ware or Southern Paiute Brown Ware) and Desert Side-notched projectile points. Jeddito Yellow Ware pottery, a widely traded Hopi product, is also a common diagnostic of this time period.

Some scholars place the beginning of the Grand Canyon's historical period in 1540, the year that Hopi guides led a small force of Spanish soldiers under the command of García López de Cárdenas to the South Rim of the Grand Canyon. However, for more than two centuries after that first Spanish foray, the Grand Canyon remained outside the realm of Euroamerican affairs. Certainly, the tribes living around the Grand Canyon were indirectly affected by the presence of Spanish settlers in New Mexico and California during those intervening centuries through the aquisition of trade goods, livestock, and Old World diseases, but there are very few written records of those impacts, and, as of yet, no archaeological research has been undertaken in the Grand Canyon region that provides additional information about that era. For the purposes this research design, therefore, we have designated the period from A.D. 1540 to 1776 as the protohistoric period, with the preceding 240 years (A.D. 1300–1540) designated as the late prehistoric period.

There is still no firm consensus among archaeologists concerning the timing of the arrival of Southern Paiutes and Pais in the Grand Canyon region. Euler (1974) placed the arrival of the Pai people sometime after A.D. 1150 and before 1300, with the appearance of Southern Paiutes on the North Rim of the Grand Canyon at about the same time (Euler 1964, 1974). Dating the arrival of Southern Paiute and Pai in the Grand Canyon region presupposes that no cultural continuity exists between the Cohonina and the Pai on the one hand, or between the Virgin Anasazi occupants of the Arizona Strip and the Southern Paiute people on the other. Though most archaeologists accept the Euler version of Grand Canyon prehistory, which posits a break of a century or more between the Late Formative period and the late prehistoric/protohistoric period, some archaeologists think the evidence is equivocal and open to other interpretations (e.g., Linford 1979; Simonis 2001).

Southern Paiute and Pai cultural scholars also dispute the prevailing archaeological version of their cultural history in the Grand Canyon (Vivian Jake, personal communication 1993; Roland Manakaja, personal communication 1995). They trace their residency in the region to "time immemorial." Yet, both groups acknowledge a beginning outside of the Grand Canyon region, and neither group claims to have been the first to occupy the region. Both the Hopi and the Southern Paiute, for example, have oral traditions testifying to a former relationship at a distant time in the past when ancestors of the Hopi lived north of the Colorado River (Heizer 1954:3; Little 1881:63, 105; Peterson 1971:183; Whiteley 1988:8). One published version of the Pai origin story described the creator of the Pai as living in a stone dwelling (Ewing 1961:10), which may be a reference to the existence of masonry structures predating the Pai's arrival in this land. Although both groups claim to have been created outside the region, and neither group claims exclusive occupancy of the Grand Canyon in the distant past, both the Southern Paiute and the Pai view their ancestral histories and current cultural identities as being inextricably tied to the Grand Canyon region. Archaeologists working with late-prehistoric and protohistoric sites have relied heavily on ethnographic and ethnohistoric accounts (e.g., Euler 1966a; Kelly 1934, 1964; Kroeber 1935; Spier 1928) to interpret archaeological finds dating to this time period. Inasmuch as these studies were conducted many decades after Pai and Southern Paiute cultures had been modified by the impacts of Euroamerican diseases, slave raiding, livestock grazing, and the usurption of prime farming areas and water sources (Dobyns and Euler 1998; Stoffle and Evans 1978), the reliability of ethnographic models as accurate depictions of prehistoric lifeways is somewhat suspect. For example, Kelly (1964) describes the traditional Kaibab Paiute subsistence model as follows: during late winter or early spring, the bands moved from mid-elevation winter base camps along the wooded flanks of the

Kaibab Plateau into the Grand Canyon to harvest agave, and then back to mid-elevation areas, such as House Rock Valley, in the summer months to cultivate small, spring-watered gardens and gather grass seeds. In the fall, they moved on to the high plateaus to hunt deer and gather berries and then returned to the mid-elevation base camps at the start of winter. Although this model is probably a fairly accurate depiction of the late-nineteenth-century Southern Paiute subsistence patterns in general terms, there was undoubtedly considerable variation in the timing of movements by specific bands during any given year, as well as in the seasonal range of resources exploited. Furthermore, the high degree of mobility Kelly describes may have been a product, in part, of post-Mormon colonization of the Paiutes' prime habitation areas, which were adjacent to major perennial springs along the base of the Vermilion Cliffs (Stoffle and Evans 1978). These areas were prime agricultural locations, and early historical accounts by Ashley and others (Euler 1966a) suggest that agriculture played a considerably larger role in Southern Paiute traditional lifeways than later ethnographic accounts portray.

A similar argument has been made for historical changes in traditional Pai subsistence patterns (Dobyns and Euler 1999). Like their northern neighbors, the ancestral Pai were heavily dependent on hunting and gathering for sustenance, but they also practiced small-scale garden cultivation in a few well-watered locations. Like the Southern Paiute, the Pai relied extensively on springs and associated plant resources. Their principle upland base camps, reoccupied generation after generation, were invariably located adjacent to perennial springs (Dobyns and Euler 1999:165; Kroeber 1935). With the arrival of Euroamerican miners and settlers in the 1850s and 1860s, these traditional use patterns were severely disrupted, forcing the Pai into more remote, agriculturally marginal territory.

Like the Southern Paiute, the traditional annual subsistence cycle of the Pai people involved gardening near springs in the summer months and moving between low-elevation and high-elevation areas prior to the planting seasons and after the harvest seasons. However, there appears to have been considerable variability in the seasonal-transhumance pattern followed by the various Pai bands. For example, the Pine Springs band typically lived on the plateau near Pine Springs in the summer and fall, but wintered within the Grand Canyon near Dr. Tommy's Mountain (Dobyns and Euler 1999:160). According to Dobyns's Pai informant, John Matuck, "their food was deer meat, mountain sheep meat, jack rabbit, other small animals, Ikwauv', 'I'll'i, Spanish dagger pears (*manad*), pine nuts, other weeds or plant seeds." The more westerly Grass Springs band resided near their namesake in the summer months but lived along the river in the winter months because "there are a lot of mesquite beans" (Dobyns and Euler 1999:160). In contrast, the Blue-Green Water Pai (Havasupai) summered within Havasu Canyon and other low-lying canyons with perennial streams (Dobyns and Euler 1999:161) and wintered at higher elevations on the surrounding pinyon-juniper-covered plateaus.

It remains to be determined whether the seasonal-use patterns documented in the ethnohistorical record were similar to those followed in the more distant past. In terms of actual archaeological data derived from excavated late prehistoric and protohistoric sites in the Grand Canyon, the record remains exceedingly slim. Three of the four shelter sites tested by Jones (1986) contained deposits dating to the late-prehistoric time period: AZ A:16:1, AZ B:15:7, and AZ C:13:4. In fact, it was the presence of late prehistoric/protohistoric deposits in these shelter sites that prompted Euler to target them for excavation in the first place (Euler 1974). Euler hoped that these sites could provide information about the timing of the arrival of Pai and Paiutes in the Grand Canyon, and that the information gathered might put to rest arguments concerning continuity, or contemporaneity, between the Formative period occupants of the Grand Canyon and later historical cultures (Euler 1974:145). At AZ A:16:1, along the Colorado River near Whitmore Wash, the uppermost stratum contained Paiute ceramics. This upper layer overlay deposits containing Pueblo II Virgin Anasazi ceramic types. A distinct break was visible between the deposits. Jones (1986:105) obtained a 2-sigma calibrated radiocarbon date of cal A.D. 1230–1340 from a roasting pit in the Paiute level, but regrettably did not obtain any comparative dates from the Virgin level. At AZ B:15:7, a few miles north of the river in upper Tuna Creek, a distinct, sterile layer 20–50-cm-thick separated deposits containing Paiute and Jeddito Yellow Ware sherds from a lower stratum containing Virgin ceramics. Analysis of the intervening sterile deposit revealed that it was the product of a single cut-and-fill event (probably a debris flow) and, hence, did not necessarily indicate a long break in occupation between the two deposits. Interestingly, at this site, the upper level produced a 2-sigma calibrated date of cal A.D. 1320–1425, whereas the lower level (under the debris flow) produced an essentially contemporaneous date of cal A.D. 1205–1490 (Jones 1986:105), suggesting that the temporal interval separating these two occupations was relatively brief.

At AZ C:13:4, the Beamer Cabin site, and also at AZ C:13:10, the Furnace Flats site, surprisingly late dates in the A.D. 1200s to 1300s came from features ceramically dating to the Pueblo II period, leading Jones (1986:107–108) to speculate that the Formative occupation in the inner canyon may have lasted somewhat longer than previously assumed. Recently, NPS archaeologists tested portions of a multicomponent site at Indian Canyon (near River Mile 206) that exhibited artifacts of both Virgin Anasazi and Paiute origins (Hubbard et al. 2001). At this site, a layer of windblown sand separated an upper level of a roasting feature dating to the protohistoric or historical period (ca. A.D. 1650–1950) from Puebloan deposits dating to ca. A.D. 700–1100 (Hubbard et al. 2001:32).

Aside from the dates, what is most interesting about these various excavation results is the disparate subsistence data they produced. For example, none of the excavation results supported the traditional (Kelly 1964) model of Southern Paiute subsistence in terms of either seasonality or the types of resources being processed in the roasting pits. Hutira (1986) interpreted the macrofossils from both AZ A:16:1 and B:15:7 to be indicative of a late-spring-and-summer occupation, rather than a late-winter-and-spring occupation, as Kelly's model would predict. In addition, agave was identified only from A:16:1, whereas corn was found in both the Puebloan and Southern Paiute levels of B:15:7. Likewise, at Indian Canyon (AZ G:03:4), no unequivocal evidence of agave was recovered from the roasting pits, but tentative corn remains and clear evidence of prickly pear (*Opuntia* sp.) were found, along with mammal bones. Thus, the terms "mescal pit" and "agave roasting pit" may prove to be inaccurate functional labels for these ubiquitous fire-cracked-rock features (Figure 55).

An inordinate amount of attention has been focused on subsistence issues in the Grand Canyon relative to other aspects of culture. This is true for all time periods, but especially so for the late prehistoric, protohistoric, and historical periods. For example, we know very little about Pai and Southern Paiute lithic and perishable technologies, even though these aspects of material culture were arguably much more essential to their livelihood and cultural identities than were ceramics. Jones (1986) noted few differences between Paiute and Anasazi lithic assemblages, other than a propensity toward greater diversity of materials in the Paiute levels of both AZ B:15:7 and AZ A:16:1. In terms of Pai and Southern Paiute perishable technology, archaeologists have tended to rely on the late-nineteenth-century ethnographic collections made

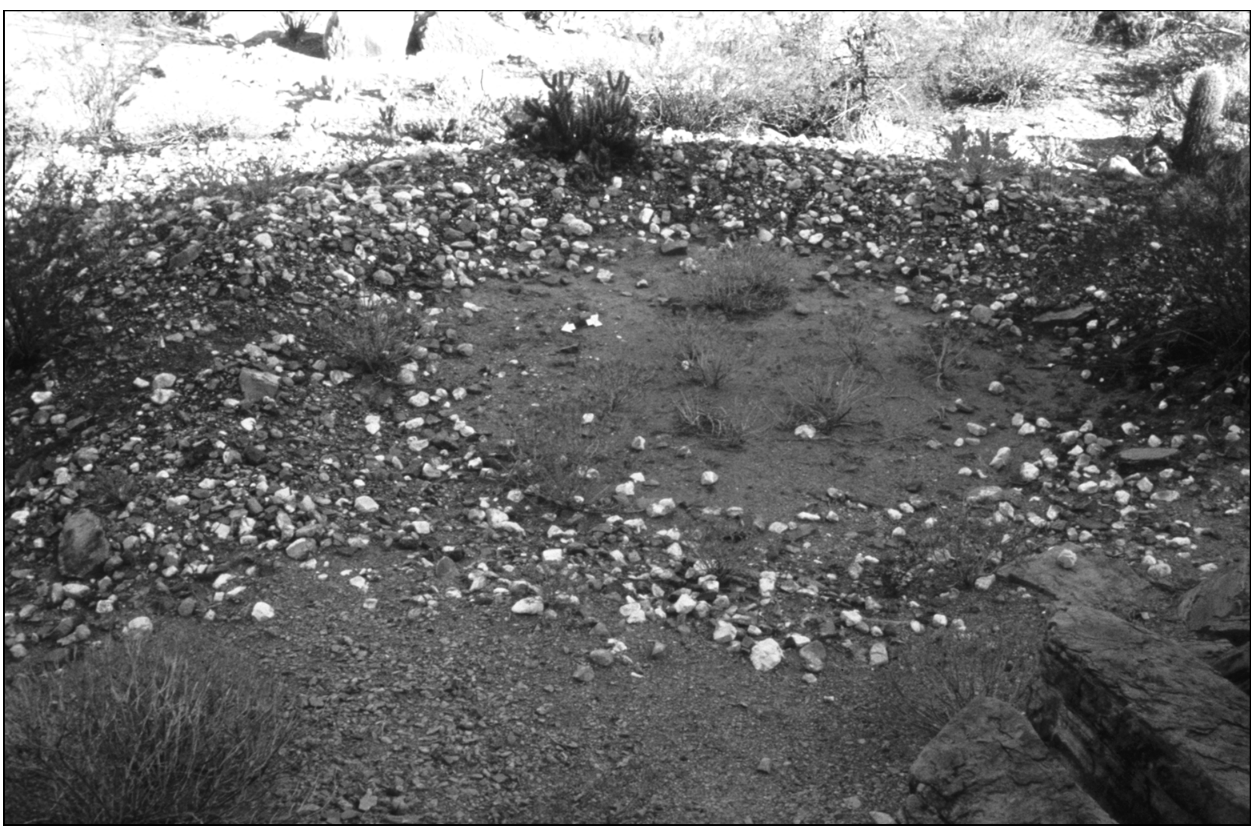

Figure 55. A typical donut-shaped fire-cracked-rock midden in the western Grand Canyon (photograph by Helen Fairley).

by Powell, Palmer, and others (Fowler and Matley 1978, 1979; McKee and McKee 1974) to describe these technologies, rather than directly analyzing materials recovered from archaeological contexts.

Historical Period (A.D. 1776–1950)

In 1776, two separate exploratory expeditions led by Spanish priests penetrated the Grand Canyon region. In the summer of 1776, Francisco Tomás Garcés journeyed up the Colorado River through Haulapai territory, eventually reaching the Havasupai settlement in Havasu Canyon on June 20 of that year. Throughout the journey, Garcés was treated hospitably by the region's residents, who freely shared their knowledge of the surrounding country and its inhabitants with the inquisitive friar. At the same time, a separate expedition under the leadership of Silvestre Vélez de Escalante and Francisco Atanasio Domínguez was working its way westward north of the Colorado River toward California. Three months later, forced to turn back by the impending winter, Escalante and Domínguez found themselves skirting the North Rim of the Grand Canyon in search of a feasible place to cross the Colorado. Along the way, they encountered several bands of Southern Paiute, who shared their meager resources and directed them eastward to the ford in Glen Canyon that later became known as the Crossing of the Fathers. Fortunately for historians, both of these expeditions were led by enlightened and literate men who dutifully recorded their observations of indigenous cultures in considerable detail (Bolton 1950; Coues 1900).

For the next 90 years, written references to the Grand Canyon are sparse, but beginning in the mid-1800s, with the arrival of Mormon explorers from the north, followed shortly thereafter by government explorers and scientists, written records about the Grand Canyon become increasingly robust and abundant (Fairley 1989b:153–186; Hughes 1978; Pyne 1999). The availability of journals, official reports, personal letters, and the like has tended to overshadow the rich historical archaeological record in the Grand Canyon as a potential information source. For example, in his interpretation of the 82 sites with historical-period remains documented during the 1990–1991 inventory of the river corridor Coder (1994:113–146) relied extensively on written sources to establish the sites' historical context, placing relatively little emphasis on the material contents of the sites themselves. Future study of these sites could potentially reveal valuable insights about the nature of inner-canyon occupation reflecting both Euroamerican and Native American activities during this fascinating period.

Because of the heavy reliance on Euroamerican documentary sources, indigenous use of the inner Grand Canyon during the historical period has received relatively little attention. Yet it appears that, in some respects, Native Americans may have made more extensive use of the inner canyon during this time period than in previous centuries, owing to the pressures placed upon them by the Euroamerican invasion of their aboriginal lands. We know, for example, that Navajo bands were pushed westward during the 1850s and hid out in the Grand Canyon during the early 1860s. Spier's (1928) Havasupai informants remarked on the arrival of Navajo tribe members in their territory at this time, and Navajo informants for the Indian Land Claims investigations testified that one Navajo band resided with the Havasupai at Indian Gardens for a couple of years and also lived in Cataract Canyon as guests of the Havasupai after that time (Brewer 1937). Evidence for Navajo use of the eastern canyon region before the mid-1800s is weak, and this topic remains a source of controversy among scholars today (cf. Begay and Roberts 1996; Roberts et al. 1995). No clear-cut evidence for a nineteenth-century Navajo presence in the river corridor below Lees Ferry was identified by the 1990–1991 inventory; however, Pinyon Utility Ware had been previously found on the Tonto Platform near Hance Creek (Figure 56) and in the Grand Canyon Village area of the South Rim. Subsequently, a sherd of Pinyon Utility Ware was reported by a Navajo representative on a GCES-sponsored river trip near Palisades Creek (Begay and Roberts 1996:205). Navajo informants for the GCES project also interpreted the circular structures at the mouth of Crystal Creek (AZ B:16:3) as Navajo structures, although the ceramics found there do not support this interpretation. Like other Native American sites of this era without diagnostic pottery, however, early historical Native American sites are notoriously difficult to recognize. Thus, some sites lacking diagnostic ceramics could, in fact, be the product of Navajo use of the river corridor in the early nineteenth century.

At about the same time that the Navajo were seeking refuge in the eastern Grand Canyon, in the southwestern portion of the region, the Hualapai were coming under increasing pressure from miners and the settlers who traveled by wagon train through their domain (Dobyns and Euler 1970; U.S. Senate 1936). Meanwhile, north of the river, the Southern Paiute were being displaced from their prime agricultural and gathering areas by Mormon settlers (Stoffle and Evans 1978). Both Hualapai and Southern Paiute sought refuge in the remote reaches of the Grand Canyon during this time (Euler 1966a:69; Smithson and Euler 1994:2; Spier 1928:360–362). The garden that

Figure 56. A nineteenth-century Navajo pot cached under a rock in upper Hance Creek (courtesy of Grand Canyon National Park Archaeology Program).

Powell and his men found below Lava Falls in 1869 may have been a product of this desperate time. The mixture of Pai and Paiute ceramics, along with purple glass and scraps of metal found in the vicinity of Granite Park (AZ G:3:3, AZ G:3:27, AZ G:3:28), may also date to this time period. Both Hualapai and Southern Paiute informants identified the western river corridor as a meeting ground for both groups in the 1860s and 1870s (Hualapai Tribe 1993:43; Stoffle et al. 1994:173; Stevens and Mercer 1998:12). In addition, beginning in the late 1880s and continuing intermittently throughout the early 1890s, both Pai and Paiutes sought relief from the unbearable stress of Euroamerican domination by taking up the Ghost Dance ceremony in hopes of ridding the world of their oppressors and bringing back their many recently departed friends and relatives. The inner Grand Canyon provided a suitably remote and protected location for these nativist ceremonies. At least one site in the river corridor—upper Whitmore Wash (AZ A:16:1)—may be associated with Ghost Dance events (Stoffle et al. 1994:166), and other possible Ghost Dance locations maybe present on the south side of the river corridor (Smithson and Euler 1994:2; Stevens and Mercer 1998:12).

With the advent of Euroamerican explorers and surveyors in the late 1860s, 1870s, and 1880s, seasonal use of the inner Grand Canyon by various Native American groups was rapidly overshadowed by that of Anglo newcomers. The detritus left by late-nineteenth-century trappers, surveyors, prospectors, and tour guides dominates the cultural landscape after 1880 (Figure 57). However, oral traditions (e.g., Begay and Roberts 1996; Ferguson 1998) indicate that Native American people continued to make use of the inner canyon at least on an occasional basis throughout the following century. Despite documented use of the river corridor by Native Americans during the late historical period, all but a handful of the historical archaeological sites in the river corridor are classified as Euroamerican; most of the remainder are classified as unknown. This appears to reflect an inherent tautological bias in the interpretation of the river corridor's historical archaeological remains. That is, if the site contains Euroamerican artifacts, it is assumed to be historical and the product of Euroamerican activities, and, therefore, by definition, only Euroamericans are recognized as having been present in the river corridor during the historical time period. A more critical examination of the historical archaeological record from the river corridor is clearly warranted.

Even those sites that are clearly the product of Euroamerican activities, such as sites documented with photographs and written accounts, deserve closer examination from a material-culture perspective. The river corridor contains old boats, cabins, camps, corrals, inscriptions, foundations, mining debris, proposed dam sites, stock trails, and survey markers. These diverse artifacts testify not only to the variety of human activities that took place in the river corridor, but they also have the potential to shed light on the nature of local economies, late-nineteenth-century mining technology, travel patterns, social status, and the broader community relationships of the people who left these remnants along the Colorado River in lower Glen Canyon and the Grand Canyon. The potential of the river corridor's historical-period sites to address broader theoretical issues and answer questions of an anthropological nature has yet to be tapped.

Coder (1994) organized the discussion of historical-period sites in the river corridor under a number of themes: mining, engineering and Reclamation, Lees Ferry, the stock industry, and recreation and adventure. With the addition of dates, these themes outline

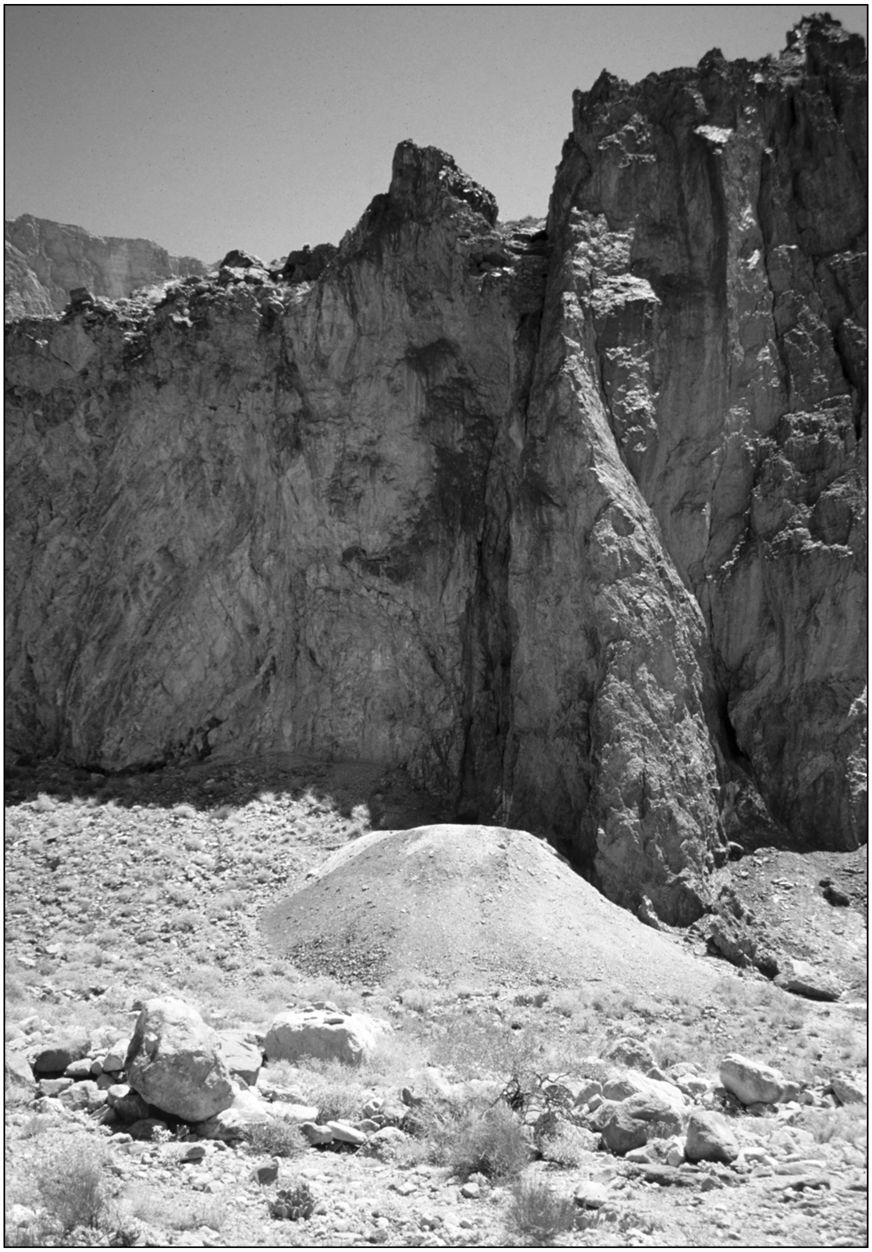

Figure 57. Tailing pile associated with the Tanner-McCormick mine (AZ C:13:98) near Palisades Creek in the eastern Grand Canyon (photograph by Helen Fairley).

the diverse historical contexts that contribute to the historical cultural landscape of the river corridor, for example, prospecting and mining (1871–1920), engineering and dam building (1889–1963), the development of Lees Ferry (1857–1928), the western American stock industry (1869–1950), and recreation and adventure (1896–1950). Additional historical contexts that are applicable to river-corridor sites but were not explicitly discussed in the 1990–1991 archaeological survey report include the late-eighteenth- and nineteenth-century indigenous adaptation to the Euroamerican invasion (1776–1950), the late-nineteenth-century exploration of the Grand Canyon region (1869–1890), turn-of-the-century tourism (1880–1920), and National Park development (1919–1950) (Anderson 1998, 2000; Hughes 1978). In combination, these contexts form a framework for organizing the future study, analysis, and interpretation of historical archaeological remains within the river corridor.

CHAPTER 6

Land, People, and Landscape

To place this research design within a historical framework, the preceding chapters have summarized and synthesized past research and the various theoretical frameworks that have been used to organize and explain patterns of cultural remains found in and around the Grand Canyon. Ongoing controversies and conflicting interpretations have been highlighted, and crucial data gaps have been identified. I have explored the strengths and weaknesses of existing evidence and have identified some of the commonalities in previous observations.

As the preceding chapters indicate, relatively little archaeological research in the Grand Canyon has been driven by explicit theoretical concerns. Beginning with John Wesley Powell's use of the direct historical approach, most research has been inductive. In various cultural-resource inventories, individual archaeological sites have been identified and placed within a cultural-historical framework that views the human story of the Grand Canyon as a parade of successive cultural groups moving into and then out of the area. The few attempts to understand Grand Canyon prehistory from a more explicitly theoretical perspective have relied heavily on the concepts of resource competition and risk mitigation as the primary agents driving processes of cultural change into the region (e.g., Effland et al. 1981; Sullivan 1996). These approaches contrast with those of most indigenous Native American groups, who view their cultural history in terms of complex, spiritually destined, long-standing reciprocal interactions with a living, sentient land, and, to a lesser extent, as a continuing story of complex social interactions with neighboring groups.

Landscape Anthropology: An Alternative Approach to Researching and Understanding Grand Canyon Human History

All cultures apply meaning to the world in which they live. This meaning is expressed through our behavior in relation to the world around us. This behavior leaves its traces—landmarks—across the land (Zedeño et al. 1997), often in recognizable patterns, but other times, in very specific and unusual ways. As Whittlesey (1998:22) observes succinctly, "In the landscape, we can read the forces of cultural development, evolution and change, and the political forces that shape human destinies." In other words, through culturally prescribed interactions with surrounding environments, humans transform the land into a landscape.

In his recent book, *Human Natures: Genes, Cultures, and the Human Prospect*, evolutionary anthropologist Paul Ehrlich argues that culture, in the broadest anthropological sense of the term, provides humans with the key evolutionary advantage and essential adaptational mechanism necessary to successfully compete with other species for the earth's resources (Ehrlich 2000). The success of our species is largely based on the fact that, unlike other creatures, we humans have the capacity to alter our cultural templates very rapidly (compared to genetic mutations) in order to adjust to changing needs and circumstances in a dynamically evolving world. Ehrlich notes that this capacity has had both positive and negative consequences for our species. Although cultural adaptation has allowed us to outcompete other organisms, it has also resulted in many of the environmental crises facing us today. In other words, Ehrlich argues that human culture is not merely an artificial construct that we have imposed on the "natural" environment; it is a dynamic force interacting with all the other dynamic components that constitute the ecosystem in which we live.

The term "landscape theory" has been used to characterize this dynamic, interactive perspective on culture and land (Whittlesey 1998). The term "landscape anthropology" is probably a more appropriate label, however, because we are referring to an intellectual framework rather than an explanatory vehicle. The landscape approach borrows theoretical constructs from several disciplines, including ecology and geography, to provide an intellectual framework for understanding how human beings relate to, embrace, and "construct" their universe.

Incorporating the conceptual work of Crumley and Marquardt (1990), Marquardt and Crumley (1987), Tilley (1994), Zedeño et al. (1997), and others, landscape anthropology articulates the dialectical nature of diverse processes that are traditionally categorized as either "cultural" or "natural." In landscape anthropology, the natural/cultural dichotomy is diminished in favor of a perspective that views natural and cultural processes as mutually reinforcing and interacting through time. Rather than viewing human culture as an adaptational process acted out on a shifting environmental stage, or viewing nature as a force that operates upon and shapes human cultures, the landscape approach integrates these concepts. This interactive perspective encourages the study of archaeological cultures as evolving, dynamic components of larger dynamic ecosystems rather than as static entities interacting with each other and the environment over time. (See Whittlesey [1998] for a discussion of the historical roots of landscape theory.)

Perhaps most valuable of all, the landscape approach allows archaeologists to explore the intangible realms of human ideology and cognition from a perspective that would otherwise be unavailable to them. As noted by many different anthropologists, a sense of place is essential to most traditional people's self-identity (Basso 1996; McPherson 1992; Whiteley 1988; Zedeño et al. 1997). Through a history of interaction with a particular area of the world, human identities become wedded to that land. To explore this topic in prehistoric contexts, we need to think not only in terms of possible meanings ascribed to geologic or topographic landmarks or to culturally significant clusters of environmental attributes on the landscape (Stoffle and Zedeño 2001a) (which may or may not be possible to deduce from archaeological evidence) but also in terms of the many different kinds of constructed landmarks, including the built or otherwise spatially organized environment created and inhabited by people.

For example, consider the fact that ancestral Puebloan people typically buried dead infants beneath the floors of inhabited rooms, whereas deceased adults were placed in middens directly outside the rooms. Was this because (as some archaeologists have suggested) it was expedient to dig in those places, or was it a reflection of the prehistoric people's belief about some connection existing between the deceased and their homes? The answer, in this case, seems patently obvious. Soil compaction was not a consideration, whereas the maintenance of belief systems clearly was. Although we cannot identify with certainty the specific beliefs held by people a thousand years ago, we can, nevertheless, recognize their existence in the archaeological record. By extension, when we observe anomalies in traditional burial patterns, such as the skeletal remains burned and deposited in the kiva at Unkar (Schwartz et al. 1980:246), it may be more productive to consider this as a tangible expression of conflicting ideologies encountering each other along a dynamic and evolving frontier zone, rather than simply ascribing it to internecine violence.

Landscape: Definitions and Key Concepts

Anschuetz et al. (2001) recently reviewed the diverse applications of landscape concepts in archaeology. This review demonstrates not only a lack of consensus concerning the meaning of the word "landscape," but also considerable variation in the way that the term has been applied historically in archaeological studies. Landscape, as defined by Crumley and Marquardt (1990:73), is "the spatial manifestation of the relations between humans and their environment." Greider and Garkovich (1994:1) place greater emphasis on the conceptualized, or symbolic, aspects of landscapes in their definition: "the symbolic environments created by human acts of conferring meaning to nature and the environment, of giving the environment definition and form from a particular angle of vision and through a special filter of values and beliefs. Every landscape is a symbolic environment. These landscapes reflect our self-definitions that are grounded in culture."

Landscape does not only embody the spatial aspects of human relations with their environment and the symbolic constructs ascribed to that environment. It also encompasses temporal and evolutionary aspects. In this sense, our definition of landscape is closer to the one proposed by McClelland (1991:108) for cultural landscapes: "the product of a dynamic process of continuity and change driven by natural and cultural forces." McClelland goes on to note: "Tension—between past and future, between change and continuity, between conflicting and competing social and political interests—has historically marked the evolution of cultural landscapes." It is this dynamic, vital essence of prehistory and history embedded in the land toward which we hope to direct future research, using landscape anthropology as the framework for structuring this research design.

Native American Concepts of Landscape

Stoffle et al. (1997; Stoffle and Zedeño 2001a) have reviewed some of the disparate approaches used by various anthropologists and land managers to try to capture the landscape-level concerns of Native American people seeking to protect culturally important lands and places. Diverse terms, including sacred geography (Walker 1991), spiritual geography (Griffith 1992), symbolic landscapes (Greider 1993), and ethnographic landscapes (McClelland et al. 1999) have been applied to landscapes modified and conceptualized by humans. Stoffle et al. (1997) argue that none of these terms does justice to the full spectrum of values embodied by landscapes, although each captures a part of what makes landscapes significant. They suggest that most Native Americans conceptualize landscapes in terms of five major categories: (1) holy landscapes, (2) storyscapes, (3) regional landscapes, (4) ecoscapes, and (5) landmarks. The first three landscape categories may be spatially overlapping, or they may be geographically separate. Holy lands usually encompass the place of origin for a particular group, as well as the area they were destined to inhabit. Storyscapes can embody stories about the mythical past, as well as stories about events rooted in the more recent historical past. Stories form the connective "fiber" rooting people and their traditions to landscapes. The third category, regional landscapes, essentially describes geographic areas where a particular cultural group made their living, and, hence, this category may overlap with both holy lands and storyscapes.

Stoffle et al. (1997) propose two internal divisions of regional landscapes: ecoscapes and landmarks. They define an "ecoscape" as "a portion of a regional landscape that is clearly defined by an unusual or distinct local geography and its unique cultural relationship to an American Indian group or groups," whereas "the term landmark refers to a discrete physical place within a cultural landscape" (Stoffle et al. 1997:237). For this research design, the Grand Canyon and the plateaus that surround it fit the definition of a regional landscape, whereas the river corridor is a specific ecoscape within the larger regional landscape. Archaeological sites, springs, mineral sources, and topographic features are some of the landmarks that can be found within this ecoscape.

Ecological Concepts

Ecologists often conceive of landscapes in terms of mosaics composed of "patches" and "edges" (Forman 1995). The interface between patches of similar vegetation produces edges, which usually are distinguished by a greater diversity and abundance of species, the so-called "edge effect" (Thomas et al. 1979; Yahner 1988). Edges include not only species from neighboring patches, but also species uniquely adapted to the edge environment. Edges, therefore, are not only boundaries, but also distinct habitats unto themselves. Somewhat comparable concepts in landscape anthropology include regions, territories, and boundaries (Whittlesey 1998:23). Region, for the purpose of our research design, is broadly conceived to encompass geographic space "at a scale at which certain phenomena exhibit a recognizable distribution" (Marquardt and Crumley 1987:3). In other words, the size of the area considered in this research design varies depending on the nature of the particular phenomenon being studied.

The concepts of territory and boundaries are intertwined, one being zonal in nature and the other linear. As defined by Whittlesey (1998:24), "[b]oundaries are artificial divisions of the physical landscape that serve as [both] edges and centers within the landscape being studied. This inherent duality makes them interesting phenomena (Crumley 1979; Green and Perlman 1985)." One might add that boundaries, though conceptualized as artificial, are often grounded in physical features, such as a rugged (but usually not impassible) mountain range or a seasonally raging river. Territories, on the other hand, are much more difficult to define (see Zedeño [1997] for a discussion of how this concept has been approached by various disciplines). It is necessary for these definitions to be flexible, because the concept has different meanings in different cultures and at different scales. This fact became readily apparent during the Land Claims cases of the 1940s and 1950s, when federal bureaucrats tried to use European notions of territoriality to determine the appropriate level of compensation due each tribe. Ethnohistorical studies undertaken for the Land Claims Commission documented multiple, overlapping claims to many areas of the Southwest, including the region around the Grand Canyon. Only rarely could evidence be found that established exclusive use of a given area by one specific group of people over time. This is not to say that indigenous southwestern people did not have a sense of territoriality. They did, but the concept of exclusive ownership was not part of it. Boundaries, in other words, were there, but their existence did not preclude others from crossing them (Williams 1982).

The concept of boundary is particularly important to this research design, because although the Colorado River corridor does not incorporate complete cultural territories during any time period, the river and the canyon have frequently been conceived of as a boundary or frontier zone separating cultures, and it is often depicted as such on cultural maps of the region (e.g., McGuire 1983; Schwartz 1983). Moreover, we know from historical and ethnographic accounts that the Colorado River served as both a cultural and physical boundary between the Pai and the Southern Paiutes (Spier 1928), as well as between the Hopi and the Southern Paiutes (Whiteley 1988). Today, the Colorado River continues to serve as a political boundary for the Hualapai and Navajo Nations. Therefore, the changing nature of cultural boundaries and their expression on the landscape is necessarily a key component of this research design.

In terms of ecological theory, boundaries may serve multiple functions, including: (1) habitat, (2) filter, (3) conduit, (4) source, and (5) sink (Forman 1995:96). Translated into cultural terms, boundaries can serve as common meeting grounds or neutral territories, promoting interactions among otherwise separate groups. Boundaries may serve as filters, allowing some material goods and ideas to cross from one group to another, while still maintaining the separate cultural identities of each population. Boundaries may also serve as corridors, allowing goods and ideas to be transmitted along the edges of territories, rather than across them. In addition, boundaries can serve as the breeding ground for entirely new patterns or ideas that result from the interaction of disparate cultural phenomena. Finally, boundaries may function as sinks, as when two antagonistic groups refuse to give ground to one another, resulting in the destruction or isolation of one or both groups. In all cases, however, the function of cultural boundaries is determined primarily by culturally prescribed values and activities rather than by physical or biological parameters.

Archaeological Boundaries

Boundaries, as reflected in the archaeological record, raise many theoretical dilemmas. Geib (1996:98–116) provides an interesting exploration of this issue in his discussion of the Formative occupation of Glen Canyon, one that applies equally well to Grand Canyon archaeology. The fundamental issue concerns whether, and how well, material culture serves to distinguish cultural groups. Without recapitulating the entire history of intellectual discourse on the subject of archaeological cultures, social identity, ethnicity, and boundaries (see Shennan [1989] for an overview; see also Geib 1996:108–112), it is important to recognize that the culture-area concept and the idea of archaeological cultures presupposes the existence of boundaries separating one culture from another. Archaeologists have typically conceptualized boundaries as being either "fluid" or "hard," depending on the degree to which traits from one cultural area overlapped with or co-occurred in another. However, archaeologists have devoted relatively little discussion to the cultural processes that could produce and perpetuate these different kinds of boundaries. Instead, they have been largely preoccupied with trying to make sense of the cultural phenomena that result in the creation of stylistic differences in the archaeological record, the fundamental basis for distinguishing "archaeological cultures."

The whole concept of cultural-boundary recognition in archaeology is intertwined with theoretical discussions concerning the various and diverse meanings of style in material culture (e.g., Hegmon 1998; Sackett 1982, 1985, 1986, 1990; Sampson 1988; Stark 1998; Weissner 1982, 1983, 1984, 1989; Wobst 1977). Archaeologists have hypothesized a variety of possible reasons to account for the development of stylistic differences between groups. Very briefly, on one end of the spectrum, there is Sackett's position that styles evolve and are perpetuated without any explicit intent to demonstrate social identity ("this is the way we have always done it"); on the other, there is Weissner's notion that people assert their identity through the use of style, and that this positive assertion of an image ("we do it this way because we are the Cohonina") has evolutionary advantages in terms of establishing beneficial reciprocal relations with neighboring groups. As Geib (1996:109) points out, "All cultural traits would not have equal value in this regard, since many lack symbolic content. . . . Public symbols, such as rock art, body decoration, dress and hairstyles, are effective means for identifying members and contrasting them with outsiders. Esoteric symbols, or those with little public exposure can function just as effectively, although only in a unilateral sense, to foster and perpetrate [*sic*] in-group cohesion." In terms of boundary recognition, Geib (1996:109) summarizes the crux of the issue as follows:

> To the extent that material culture was an essential aspect in the development and maintenance of social boundaries, such as in signaling groups membership (e.g., Weissner 1983, 1984, 1989), then material culture would have relevance for identifying the spatial (archaeological) expression of such boundaries. . . . [S]ome material remains might be deliberately used as symbols of ethnic identity . . . though whether a particular style functioned as

such in prehistory is a matter of empirical investigation, cogent reasoning, and perhaps faith.

Landmarks

Zedeño (1997) describes four basic sets of human activities that result in characteristic signatures on the landscape: living, food production, resource procurement, and ritual. Whittlesey (1998:24) adds a fifth activity: communication. In every culture, these activities are carried out in culturally prescribed patterns and in spatially prescribed areas. Analysis of the patterns and spaces attributed to each activity within different cultural systems allows us to discern multiple landscape layers within a given area. When we add in the temporal dimension, the juxtaposition of contemporary landscapes—whether side by side or perhaps spatially overlapping one another—allows us to make inferences about the existence of prehistoric cultural boundaries and the extent to which they were permeable, if at all. Thus, chronology and the temporal ordering of material culture are issues of central importance to the definition of landscapes and cultural boundaries.

Landscapes and Scales

The concept of scale is essential to any research endeavor involving a landscape approach. Landscapes are expressed at many different scales, both spatial and temporal, and therefore must be studied at a variety of different scales to be fully appreciated (Marquardt and Crumley 1987). In the spatial dimension, scale can be conceived of as a series of nested bowls incorporating progressively widening analysis domains (Bischoff et al. 2000:113). Whereas some research issues are feature or site specific, others can only be approached by taking a much broader perspective, such as one that incorporates a macroregional level of analysis.

For the purposes of settlement analyses, the continuum of space is often conceived of in terms of three basic scales: (1) local (spatial relationships between the smallest units relevant to settlement analysis), (2) regional (relationships between larger areas within a given politically or geographically defined entity), and (3) supraregional (relationships between regional entities) (Bischoff et al. 2000:113; Dowdle 1987). Most previous archaeological studies in the Grand Canyon have tended to focus on relationships at the intermediate level of analysis (i.e., intraregional as opposed to site specific). The current data-recovery approach in the Grand Canyon continues this emphasis, in the sense that individual features are being salvaged in a manner that does not allow for the study of intrasite relationships, but rather with the ultimate goal of understanding them in the broader context of the river corridor as a whole (Yeatts 2000). Ideally, however, the appreciation of landscapes requires the incorporation of spatial data at many different scales of analysis. By investigating the relationships between individual architectural elements and between aspects of the built environment and its immediate surroundings, archaeologists can reconstruct localized cultural landscapes that inform us about the essential aspects of the larger ones (Bischoff et al. 2000:133).

As noted by Bischoff et al. (2000:114), there is also "a third aspect of scale [involving] less readily definable units of culture, ethnicity, and other socially and politically constructed affiliations. Because of the intertwined nature of culture and nature, there is no single cultural landscape for all times, places, and peoples." The Grand Canyon is therefore best understood as a series of interrelated landscapes, each constructed and conceived of in different ways by the people who moved through the area over time.

Summary

Landscape anthropology provides an intellectual bridge between the traditional interests of archaeologists and those of traditional Native American people. It provides an overarching theoretical framework within which "traditional" archaeological themes—such as chronology, subsistence, social organization, settlement organization, land-use practices, and ethnic interactions—can be explored, and simultaneously allows the study of cultural processes and physical phenomena to be approached as components of a dynamically interactive world rather than as separate, static, and sometimes seemingly unrelated parts.

The landscape approach offers a geographical frame of reference within which the research potential and traditional values associated with individual archaeological sites and other landmarks of the inner canyon can be evaluated. It provides a conceptual framework for analyzing cultural resources within the river corridor that is more compatible with Native American perceptions about the workings of the universe. The landscape approach offers the potential for a common language and a familiar frame of reference for considering culturally value-laden terms such as "significance." A landscape approach will also help to bridge the gulf between the "natural science" studies being carried out in the Grand Canyon river corridor today and the site-specific interests of federal cultural-resource managers. For these reasons, we are convinced that this is the most appropriate theoretical approach to take in formulating future archaeological research strategies for the Grand Canyon river corridor.

With the aforementioned framework in mind, the remaining portion of this chapter outlines a research program to document the interactive history of past human activities and landscape processes. The landscape approach is used as a vehicle to explore, evaluate, and interpret the material record of human occupation and interaction within a dynamic desert riverine environment that forms a part of a much larger geographic context—the southern Colorado Plateau and the adjoining desert lowlands. Although our ultimate goal is to direct future inquiry toward elucidating the history of complex cultural behaviors that have shaped and given meaning to the various landscapes of the inner Grand Canyon, we propose to accomplish this not only by examining the traces of human activities embedded in the landscape, but also by engaging Native American cultural scholars in the interpretation of those traces and their spatial patterning.

We use the term "region" here in the sense proposed by Crumley and Marquardt (1987:3), as "a spatial configuration at a scale at which certain phenomena exhibit recognizable areal distribution." Thus, although the primary focus of the research design is on the inner canyon, it is necessary to look beyond the edges of the Colorado Plateau at the largest scales of analysis to fully appreciate and articulate cultural linkages with broader regional trends. In terms of a temporal framework, the emphasis is primarily on the past 5,000 years of human history in the Grand Canyon, as this appears to be the temporal extent of Holocene sediments and archaeological sites preserved within the river corridor. However, it is important to look beyond the known time span of the inner canyon archaeological record and remain open to the possibility that earlier (but as yet undiscovered) archaeological remains may be present within the river corridor. It is also important to consider the preceding human and environmental factors that ultimately gave rise to the cultural record preserved in the Grand Canyon today.

Through use of a landscape approach, diachronic human behavior and the dynamic riverine ecosystem are examined as interdependent components of a single evolving ecosystem. Making sense of this complex ecosystem requires that we identify key components and their respective data needs. To do this within a framework that fits within a landscape approach, the following section is organized under three broad topics of inquiry: land, people, and landscape. The first topic is concerned with identifying research issues and approaches that can help us understand how the physical and biological setting of the Grand Canyon river corridor has evolved and changed over time, as a result of both natural and cultural processes. Under the first topic, we propose to explore the geophysical, paleoclimatic, and biological parameters that have (1) shaped the landscape of the inner Grand Canyon over time, (2) influenced choices made by humans as they attempted to adapt and cope with the dynamic riverine environment, (3) responded to human influences, and (4) transformed the archaeological record into the remnants we see today.

The second topic is concerned with the explicitly human dimension of the Grand Canyon river corridor, specifically the definition of cultural entities and the distribution of cultural materials and patterns in space. Under the second topic, we explore several traditional themes of archaeological research: (1) chronology of human occupation and material culture, (2) cultural identities, (3) subsistence and settlement strategies, and (4) exchange.

The third topic, landscape, explores natural and cultural realms as mutually reinforcing and interacting components of an integrated ecosystem to which humans have applied meaning and value over time. Under this third topic, we examine themes relating to changing sociocultural boundaries and interactions over time, cultural transformations, and systems of communication and ideology manifested in the archaeological landscape. The third topic provides a bridge between studies of past human relations with the land and present-day perceptions and values, as well as a basis for discussing and evaluating the research values of archaeological sites in a context that is compatible with the concept of traditional cultural places.

In many cases, the basic data necessary to formulate meaningful hypotheses are still lacking. Therefore, a large portion of this chapter is devoted to highlighting the types of information needed to address some of the long-standing research issues in Grand Canyon human history, as well as the methods best suited for obtaining the necessary data.

This research design is geared toward anticipating a broad range of research endeavors that could be carried out in the river corridor in the future. This research design is not specifically focused on data recovery involving excavation, although it can certainly be used to frame site-specific research questions for future excavation projects. In the river corridor, and in the Grand Canyon in general, there is a great deal to be gleaned from additional research that does not involve excavation. For example, the 1990–1991 archaeological inventory identified 475 sites, but no detailed spatial analysis of site distributions was conducted, and only a broad-brush approach to distinguishing patterns in the material culture record was attempted. Geographic Information Systems (GIS) offers a useful tool for exploring spatial relationships of existing survey data in greater depth. Also, there is much of value that could be gained from conducting in-depth analyses of surface artifacts: trace analysis of surface obsidian artifacts (e.g., using minimally destructive laser-ablation technology) could reveal valuable information about source-area locations and trade connections over time. A monitoring program geared toward answering questions beyond "Are archaeological sites eroding?" and "Are river runners impacting sites?" could gather data relevant to Glen Canyon Dam operations, and, at the same time, improve understanding of the geomorphic and social processes operating in the river corridor today (and perhaps, by extension, in the past as well). With creativity and flexibility, this research design can be applied to a broad array of future research undertakings in the river corridor, not just excavation projects intended to meet NHPA compliance requirements.

I. The Land

The work of Cooley et al. (1977), Webb et al. (1988, 1989, 1996), Webb and Melis (1996), Melis (1997), Melis et al. (1994), Schmidt and Graf (1990), O'Connor et al. (1994), Lucchitta (1991), Lucchitta et al. (1995), Fairley and Hereford (2002), Hereford, Thompson, Burke, and Fairley (1996), and Hereford et al. (1991, 1993) has demonstrated that the sedimentary substrate of the Colorado River corridor in the Grand Canyon is subject to dynamic and complex physical processes that have been operating in the river corridor for thousands and, in some cases, millions, of years. The work of these researchers provides some general clues about the extent of change that the landscape has undergone during the past 5,000 years. Much of Melis's (1997) and Webb's (1996; Webb and Melis 1996; Webb et al. 1988, 1989, 1996, 1999) work highlights the magnitude, frequency, and far-reaching influences of recent and historical debris flows. Webb (1996) and others (Bowers et al. 1997; Karpiscak 1976; Turner and Karpiscak 1980) have also studied and documented historical changes to vegetation in the river corridor, some of which have occurred independent of influences brought about by the construction and operation of Glen Canyon Dam. Schmidt and Graf (1990) and others (e.g., Rubin and Topping 2001; Topping et al. 1999) have focused a considerable amount of research on the factors and processes responsible for the formation and modification of sandbars, and although their work emphasizes current formation processes, it has implications that stretch far back in time. O'Connor et al. (1994) documented evidence of repeated paleoflood events of a magnitude unknown to modern man. Lucchitta (1991, 1992) and Lucchitta et al. (1995, 2000) explored river-terrace-forming events during the past million years, and Hereford's work (1996; Hereford, Burke, and Thompson 1998; Hereford, Jacoby, and McCord 1996; Hereford, Thompson, and Burke 1998; Hereford, Thompson, Burke, and Fairley 1996; Hereford et al. 1991, 1993, 1997, 2000a, 2000b), as well as that of Burke et al. (2003), provides a broad outline of the Holocene geoarchaeological record, documenting distinct chapters of deposition and nondeposition within the past 3,000–4,000 years. These studies provide a framework for formulating a number of research topics and specific questions that can be addressed through future paleolandscape and geoarchaelogical field studies.

I. A. Documenting Periods of Landscape Stability Versus Change

Hereford's geomorphic studies and Davis's soil research (Davis and Davis 1995; Davis et al. 1995) independently suggest that at times in the past, hillslope and side-canyon effects dominated landscape-formation processes in the river corridor, whereas at other times, riverine processes were dominant. The extent to which the alluvial record can illuminate the interplay of these processes and possibly reveal periods of relative stability in the landscape have not yet been explored. For example, the Striped Alluvium contains multiple bands of colluvium and alluvium, representing alternating slope-wash and fluvial or aeolian events. The time intervals represented by these alternating events are unknown. If the intervals of deposition are widely separated in time, it would suggest that the Grand Canyon experienced prolonged periods of stability punctuated by relatively short, but notable, episodes of change. Alternatively, if the striped deposits are found to represent annual cycles of flood and slope-wash events, this would indicate a very dynamic floodplain environment during the time of deposition. Using soil science techniques, terrace surfaces could also be studied for evidence of soil development that is indicative of prolonged stability.

I. A. Questions

1. How does the river corridor's current physical landscape compare with that of the past in terms of rates and types of sediment deposition and erosion?

2. What do the terrace surfaces and internal terrace deposits reveal about surface changes in prehistory (i.e., can we recognize old soils, dunes, or terrace surfaces within subsurface deposits indicative of extended periods of stability, or increased or decreased erosion)?
3. Can certain periods in the past be characterized as more dynamic or less dynamic, when compared to recent pre-dam and post-dam conditions?
4. Can periods of erosion or deposition be correlated with climatic trends, as reflected in the dendroclimatological record?

Data Needs:

- Information on the current amounts and types of sediment deposition at various locations throughout the river corridor, especially in areas with high site densities
- Stratigraphic analyses focused on paleosedimentology and paleotopography
- Dendroclimatological records from the immediate vicinity of the Grand Canyon
- Radiocarbon and artifactual dating of buried strata

I. B. Paleoflood History

The history of paleofloods has important implications for understanding prehistoric adaptations and cultural choices made by people living along the Colorado River. Only one concerted effort has been made so far to examine the paleoflood record in the Grand Canyon (O'Connor et al. 1994). Hereford's work suggested that each of the alluvial packages in the eastern Grand Canyon contained evidence of multiple flood events, but no attempt was made to sort them out in terms of size, frequency, or other parameters that could have affected human behavior in the river corridor. Further examination of the stratigraphy, mapping of driftwood strands, and analysis of historical records and photographs could be applied toward refining our understanding of the frequency, magnitude, and effects of paleoflood events on the landscape and inhabitants of the Grand Canyon.

I. B. Questions

1. What was the magnitude and frequency of paleofloods during the principal periods of prehistoric occupation?
2. What magnitudes and frequencies of floods were responsible for aggradation or erosion of Holocene deposits during specific periods in the past (e.g., Preformative, Early Formative, Late Formative, etc.)?
3. How do paleoflood magnitudes and frequencies compare with the modern pre-dam record (1884–1963)?
4. What is the evidence for paleofloods inundating habitations during past periods of human occupation, and where can it be found?
5. How did paleoflood magnitude and frequency affect prehistoric and historical-period settlement choices?

Data Needs:

- Additional chronometrically controlled studies of paleo-flood stratigraphy from varied locations in Glen Canyon and the Grand Canyon to refine the research conducted by O'Connor et al. (1994) and Topping et al. (2003)
- Sedimentological evidence of flooded buried structures and site surfaces
- GIS analysis of site distributions relative to hypothetical paleoflood levels

I. C. Effects of Geomorphic Processes on Site Formation

The archaeological sites in the river corridor have been affected by a wide variety of geomorphic processes: colluvial slope wash, arroyo cutting, rock falls, side-canyon floods, mainstream floods, debris flows, and aeolian activity. Accurate interpretation of the subsurface archaeological record requires the involvement of one or more expert geomorphologists with broad experience working in arid and fluvial settings. This expertise is needed to help interpret how various geomorphic events may have affected sites and their inhabitants, as well as how postdepositional events may have altered the archaeological record. The extent and means by which sites have been affected by landscape-formation processes is critical to understanding prehistoric and historical-period human behavior in the river corridor.

I. C. Questions

1. What types of geomorphic processes were active on the landscape prior to settlement, and what processes created the immediate landscape on which sites were subsequently located?
2. What do site deposits reveal about the nature and types of landscape-forming events during the time of site occupation?
3. Is there evidence of prehistoric site modifications undertaken specifically to address geomorphic changes in the immediate site environment

(i.e., retaining walls, diversion channels, erosion-control features?)
4. How have postdepositional processes altered or removed portions of the archaeological record at sites?
5. How might postdepositional processes have helped to preserve the archaeological record?
6. What do postdepositional sediments reveal about landscape changes since the time of occupation?

Data Needs:
- Sedimentological data, such as grain-size and sedimentary-structure information indicative of aeolian, colluvial, and fluvial processes in both archaeological and nonarchaeological contexts
- Spatial analysis of walls and other nonstructural alignments at archaeological sites
- Additional areal studies of river-corridor geomorphology, emphasizing past depositional environments and paleotopography

I. D. Anthropogenic Influences in the River Corridor

The degree to which prehistoric activities may have affected the Grand Canyon landscape in the past is an appropriate research issue for the GCMRC, given its focus on current anthropogenic influences on the river corridor. Although the scale of human-caused landscape changes may seem immaterial in comparison to the major environmental changes brought about by Glen Canyon Dam, we may be underestimating the effects that human beings had on this landscape prior to 1963. With roughly 30,000 people passing through the river corridor today, impacts on the landscape from human use are apparent in the form of damage to cryptobiotic crusts and the formation of well-worn footpaths that can rapidly evolve into eroding gullies. During Puebloan times, the impacts of even a few hundred people residing and farming in the canyon, even on a seasonal basis, could have been profound. In addition to walking around and camping on beaches and terraces, prehistoric people were also building structures, clearing fields, installing checkdams, burning vegetation, digging and irrigating gardens, setting traps, collecting plants, and hunting animals. Later historical people engaged in additional intensive land-impacting activities such as mining, cattle grazing, and improving trails. As reviewed in Goudie (1984), each of these activities has the potential to transform an environment, sometimes irreversibly.

Davis et al. (2000), Homburg (1992), and Sullivan (2000) have demonstrated the potential for uncovering evidence of soil changes caused by Formative period agriculture in the Grand Canyon region; similar studies focused on the Striped Alluvial unit could shed light on the extent and intensity of Preformative horticulture. Sullivan (1996) has also considered the effects that periodic burning may have had on woodland communities. Fire may have been used as a tool for clearing new fields or promoting the growth of economically desirable species in the river corridor. The effects that prehistoric vegetation clearing may have had on aeolian processes needs to be examined.

I. D. Questions

1. Do soils in the most intensively occupied sections of the river corridor (e.g., Reach 5) contain elevated saline levels, which could possibly be indicative of irrigation horticulture?
2. Do specific levels within the Striped Alluvium show soil chemistry changes indicative of horticultural practices?
3. Do the hiatuses in the Holocene stratigraphy of the river corridor between A.D. 300–700 and A.D. 1200–1400 show any correlation with anthropogenic processes just prior to those gaps in the record? Could previous human activities be partly responsible for the observed erosion?
4. Is there evidence for increased levels of aeolian activity during the most intensive periods of human use?
5. What do organic remains preserved within or on the surface of paleoterraces reveal about prehistoric human activities? Can we detect increases in weedy species during periods of known human occupation?
6. Are there significant changes in the densities of pack-rat middens (or other species of wildlife) during prehistoric and protohistoric times that could be indicative of human overexploitation?
7. Is there evidence of change in biotic productivity during specific time periods in the past that may be indicative of deliberate human manipulation of the environment (e.g., increases in certain plant or bird species)?
8. Do charred strata occur in the sedimentary deposits more frequently than would be expected under modern conditions, and, if so, is there evidence that prehistoric people may have used fire deliberately to clear fields or for other purposes?

Data Needs:
- Soils analyses of likely farming locations and archaeological sites, including analyses of soil chemistry, pollen, and organic constituents

- Stratigraphic studies focused on identifying depositional hiatuses and charred organic layers
- Diachronic analyses of species abundance based on species-specific faunal and macrobotanical remains in archaeological middens

I. E. Spatial and Temporal Distribution of Holocene Deposits

The initial results of Hereford et al.'s (1993; Hereford, Thompson, Burke, and Fairley 1996) geomorphological research in the Grand Canyon revealed several depositional hiatuses that correspond to important periods in prehistory. These results indicate that we should be cautious about interpreting hiatuses in the archaeological record as being indicative of periods when humans were absent from the canyon; the paucity of evidence for human use during a specific period may reflect breaks in deposition or periods of erosion rather than periods of disuse. Hereford's work also revealed that alluvial packages were not uniformly distributed within the river corridor, and this patchiness could have a profound influence on subsequent interpretations of the archaeological record. For example, despite extensive efforts to locate deeply buried cultural remains, the oldest date from cultural deposits in the Hereford study areas came in around 1300 B.C. (Hereford et al. 2000a). No older alluvium was identified in the Palisades, Nankoweap, or Granite Park study areas. Consequently, no buried sites dating to the Late Archaic era were identified in these other areas. However, upstream near Lees Ferry, O'Connor et al. (1994) located a stratigraphic sequence that included a deeply buried hearth dating to 3915 ± 85 B.P. (2570–2290 cal B.C. calibrated at 1 sigma), contemporary with the earliest split-twig figurines. NPS archaeologists recently dated additional hearths in this same area at 3220 ± 80 B.P. (1680–1360 cal B.C. or 1360–1320 cal B.C. at 2 sigma) and 3560 ± 70 B.P. (2120–2090 cal B.C. or 2050–1720 cal B.C.) (Lisa Leap, personal communication 2002). Nine miles upstream from Lees Ferry, noncultural organic remains preserved within alluvial sediments in the upper levels of a high river terrace produced an uncalibrated date of 3150 ± 55 B.P. (Leap and Neal 1992). Thus, it currently appears that the most likely localities for uncovering in situ Archaic campsites along the Colorado River are to be found in the lower Glen Canyon and upper Marble Canyon reaches, where remnants of alluvial terraces dating to this time period are still preserved.

Meanwhile, 200 miles downstream, in the area informally known as "Arroyo Grande," alluvium equivalent in age to the Pueblo II unit was found to be inset against the local equivalent of the Striped Alluvium unit, but both older units were truncated and overtopped by a package of alluvium contemporaneous with the Upper Mesquite unit. This younger unit normally occurs topographically lower than the Pueblo II terraces in the eastern Grand Canyon, but in the Arroyo Grande area, the entire uppermost terrace surface is capped by the younger unit, effectively obscuring the Pueblo II and earlier aceramic sites from view. If future research confirms that overtopping of older deposits by Upper Mesquite Alluvium is a widespread phenomenon in the western Grand Canyon, it would provide an alternative explanation for the relative paucity of Pueblo II and earlier remains found in the western reaches of the canyon. In other words, the relative infrequency of Pueblo II remains may have nothing at all to do with cultural boundary phenomena, but everything to do with surface visibility. Once again, the surface evidence belies the complexity of the inner canyon's culture history because of the extensive burial of earlier terraces and associated cultural remains.

Improving our knowledge about the distribution of the various deposits will be essential to interpreting future research results correctly and for appropriate site management in the river corridor (Hajic 1985; Thompson and Bettis 1982). We need to understand not only what it is that we cannot see (e.g., Bettis and Hajic 1995), but also what is no longer there (Waters and Kuehn 1996). Understanding what is no longer there is particularly important for reconstructing cultural landscapes in a dynamic riverine environment such as the Grand Canyon.

I. E. Questions

1. Are the depositional hiatuses in the stratigraphic record documented by Hereford et al. (1993; Hereford, Thompson, Burke, and Fairley 1996) found consistently throughout the alluviated reaches of the river corridor?
2. Does the Upper Mesquite Alluvium overtop terrace surfaces throughout the western canyon or only in the Granite Park area?
3. Where are deposits predating 3500 B.P. preserved within the river corridor, and what kinds of archaeological materials do they contain?

Data Needs:

- Detailed geomorphic maps and carefully dated Holocene stratigraphic data from alluviated river-corridor locations outside of Hereford's study areas, especially in Glen Canyon and the western Grand Canyon

I. F. Types and Rates of Erosion in the Past Relative to the Present

A persistent research issue during the GCES-I and GCES-II programs concerned the effects that Glen Canyon Dam operations were having on sandbars downstream. Initially, there was interest in devising methods and means to compare the erosional rates of sandbars during pre-dam times with post-dam erosion rates, but the historical approach was abandoned in favor of one that could track changes under current operating conditions. A historical perspective on this issue would still be helpful for assessing current levels of erosion.

Hereford attempted to get at this issue, to some extent, by examining historical photographs, including aerial views of the canyon (Hereford et al. 1993). This work indicated that gullies were evolving relatively rapidly under post-dam conditions (Hereford et al. 1993). Pre-dam photographs revealed numerous gullies crosscutting the upper alluvial terraces, but the gullies appeared shallow, and they frequently died out on lower terrace levels before reaching the active river channel. More-recent aerial views showed deeper and larger gullies in some areas, and many extended all the way to the current riverbank. These observations led Hereford et al. (1993:42) to develop the hypothesis that post-dam conditions created an effectively lower base level, to which pre-dam gullies are now in the process of adjusting.

Hereford et al.'s (1993:42–44) model recognized that local precipitation is the primary driver of terrace erosion, but that current river-flow levels, coupled with the lack of annual sediment-laden floods, are contributing factors. This hypothesis remains to be formally tested. Theoretically, if the river is flowing at 5,000 cfs when a major storm event occurs, tributary erosion will be somewhat greater than if the same storm occurred when the river was flowing at 45,000 cfs, as runoff will travel less distance and slope to reach the higher-stage river. This hypothetical relationship could be tested using remote weather stations to collect real-time precipitation data, in conjunction with river-stage and -flow data, at selected sites in the canyon.

I. F. Questions

1. What do the sedimentary structures and grain sizes of Holocene deposits reveal about the relative dominance of aeolian versus fluvial processes in prehistory, and how might these processes have influenced the preservation or erosion of archaeological sites in the past?
2. What types of contacts are evident between the major sedimentary packages (i.e., between the Striped Alluvium [sa] and the Alluvium of Pueblo II Age [ap]) that may be indicative of the forces responsible for initiating past episodes of downcutting?
3. How do current precipitation regimes compare with those in the past, and are there any apparent correlations between local or regional dendroclimatological records and past episodes of erosion or alluviation?
4. Is there any observable correlation between current dam operations and observed changes in site condition (i.e., do archaeological sites and pre-dam terraces erode more rapidly or less rapidly when the dam is being operated under different regimes)?

Data Needs:

- Diachronic aerial photo imagery
- Sedimentary-structure and grain-size data from Holocene deposits
- Information on the nature of depositional contact zones in Holocene deposits
- Local dendrochronological data
- Current climatic data from the Grand Canyon correlated with locally derived dendroclimatological data
- Real-time stage/discharge measurements, precipitation measurements, and sediment-runoff data from selected locations in the river corridor (these data-collection locations do not necessarily have to be at archaeological sites)

Approaches and Methodological Considerations (Topics I. A. through I. F.)

As noted by Baker (1998:8), paleohydrologic data can serve a valuable function "as a source of creative discovery concerning hydrological processes that vary over time and space. [The] goal is not to calibrate or test models, but rather to recognize the appropriate real-world phenomena that should be modeled." Additional mapping of the Holocene deposits in the river corridor is needed to fully comprehend the magnitude of geomorphic processes that have carved, shaped, and eroded the landscape of the river corridor during the past 5,000± years. Hereford's work has provided an outline of terrace-forming intervals that could potentially be refined or perhaps substantially modified with additional work.

A multidimensional approach to studying the river corridor's geomorphic setting that focuses on understanding the underlying processes that have shaped and continue to shape the Holocene deposits in the corridor is needed to provide the broad context necessary for evaluating overall impacts to archaeological sites from erosion. In this context, the term "multidimensional" refers to analyses conducted at a broad range of scales, from microscopic (e.g., grain-size analyses) to macroscopic (additional areal mapping of Holocene deposits), and including both vertical (studies of intersite and intrasite stratigraphy), horizontal (e.g., comparisons of past depositional environments from one river reach to another), and temporal dimensions. Such an approach has the potential to substantially advance our understanding of prehistoric environmental conditions, both within the river corridor and in the region at large.

The river corridor's geomorphic history is not only a subject worthy of independent inquiry; it also offers an alternative approach for examining a variety of archaeological research topics. For example, in order to shed light on the transition from Late Archaic to Preformative, researchers may want to focus additional attention on the strata separating cultural deposits. Is there a gradation in the sediments or evidence of an obvious erosional boundary? Do the striped strata (for which the Striped Alluvium is named) represent an essentially continuous sequence of aggradation, or do they indicate that there were a series of exceptionally large floods or intensive episodes of aeolian activity punctuated by periods of extended surface stability? Answers to these questions could advance our understanding of environmental conditions prior to and following the appearance of horticulture on the Colorado Plateau. By analyzing the geomorphic record of the inner canyon in a regional context, we may also be able to help answer some long-standing questions concerning the driving forces behind cycles of aggradation and degradation in the arid Southwest.

The geomorphic studies completed in the Grand Canyon river corridor to date have important implications for interpreting the archaeological record in the Grand Canyon in other ways. First, they underscore the importance of understanding geomorphic processes for properly interpreting the range and magnitude of landscape alterations through time. These studies also illustrate why it is necessary to examine the full stratigraphic sequence of alluvial deposits in the river corridor, not just surface manifestations, in order to understand the temporal depth and complexity of Grand Canyon prehistory. At the same time, they demonstrate the necessity of documenting the spatial distribution of alluvial deposits throughout the river corridor in order to understand the extent to which the archaeological record may have been removed or modified by physical processes. Furthermore, the horizontal and vertical distribution of alluvial deposits obviously has an important bearing on subsequent interpretations of cultural interactions within a regional context (Hajic 1985; Hajic and Styles 1982). These are some of the many research issues that could, and should, be addressed by conducting additional geoarchaeological mapping studies and a more thorough analysis of the existing Holocene record in the Grand Canyon.

The prehistory of the inner Grand Canyon cannot be understood without taking into full account the physical processes that formed (and also deformed) the Holocene depositional record. Future mitigation efforts must place a greater emphasis on interpreting the complex physical processes that created and transformed the original site contexts. Researchers need to focus not only on the multiple layers of Grand Canyon culture history still hidden from view and embedded within the alluvial deposits, but they also need to place more emphasis on examining and analyzing the depositional characteristics and contexts of the strata themselves. The sedimentary strata contain critical information for deciphering human-adaptive responses to a constantly changing and evolving landscape. The current approach to excavating individual features at sites does not allow the recovered data to be placed in a meaningful geomorphic context. This is not to say that entire sites must be excavated in order to draw meaningful conclusions about the physical contexts of individual sites or features. For example, the work of Jones (1986) demonstrated that a great deal of valuable information could be obtained by exposing and analyzing stratigraphic profiles within sites. However, when only selected portions of sites or individual features are excavated, a sufficiently large area needs to be exposed and the surrounding matrix carefully examined using a variety of techniques (i.e., analyses of grain size, soil chemistry, organic contents) in order to be able to place the remains in an interpretable context. This will allow individual features and strata to be tied to the depositional context of the larger site area and the geomorphic context of the river corridor as a whole.

An accurate interpretation of prehistoric landscape evolution requires a broad understanding of how geomorphic processes are translated into physical forms. This understanding can be most readily gained by studying ongoing geomorphic processes in the river corridor along with their resulting physical manifestations. Monitoring of archaeological sites could be restructured to serve as an avenue for researching current geomorphic processes operating in the river corridor today. Currently (in 2003) the monitoring program is geared toward answering one main question: is a given site actively eroding or being damaged by visitors? As of yet, there has been no attempt to use the monitoring program to study the processes responsible for ongoing erosion or to track trends in site deterioration over time. A refocusing of the existing monitoring program or the development of an entirely independent monitoring program is needed to gather quantitative information on the types and spatial extent of observed erosional and other geomorphic processes in relation to characteristics of the physical site setting (geomorphic location, soil type, sand cover, slope gradient, vegetation cover, catchment area, drainage characteristics, proximity to river), as well as in relation to localized weather events and river flows. Currently, there is no way to link observed changes in site condition to the effects of specific geomorphic processes, nor is there any way to link observed rates of erosion to current dam operations. The hypothesized relationship between current dam operations and rates of erosion could be tested by employing remote weather stations to collect real-time precipitation data and stationary cameras to document daily changes at specific locations, in conjunction with river-stage and -flow data, which could then be analyzed for corollary evidence of erosion.

In a similar fashion, Thompson and Potochnik's (2000) predictive model of site erosion could be formally tested by intensively monitoring a select number of sites in different geomorphic settings. Thompson and Potochnik identified numerous parameters in addition to precipitation and river flow/stage that bear upon the erosion of archaeological sites. Other parameters include catchment area, slope, geomorphic setting, and the water-absorption and -retention capacity of the terrace substrate and vegetation cover. Their model theoretically predicts which gullies and archaeological sites are most susceptible and, conversely, less susceptible, to future erosion. These predictions can be tested through monitoring a sample of the terrace-based and river-based drainages and a sample of targeted sites in a manner that allows for the quantification of the rate and amount of erosion. Detailed surveys of drainage profiles, measured cross sections tied to permanent datum points, installation of sediment traps to measure the amount of transported sediment, and controlled repeat photography in combination with automated weather-station data and stream-flow data, would allow for a scientifically controlled evaluation of the Thompson-Potochnik model.

I. G. Paleoclimate

Studies designed to further our understanding of the role that climate and other processes may have played in shaping the humanly modified and naturally modified landscape are needed to place human activities within a realistic environmental context. Although the precise causes of alternating fluvial deposition and erosion in the Grand Canyon during the late Holocene are still not well understood, regional climate was clearly one important factor.

As a result of the geomorphological work conducted so far (Hereford et al. 1993), it is apparent that the alluvial chronology of the Colorado River in the Grand Canyon correlates broadly with the late Holocene chronology of the southern Colorado Plateau as outlined by Hack (1942), refined by Karlstrom (1988), and elaborated by Dean (1988:129). The Alluvium of Pueblo II Age correlates with the upper portion of the Tsegi Formation, and the Upper Mesquite Alluvium correlates with the Naha Formation in northeastern Arizona and southern Utah (Cooley 1962; Hack 1942). Erosion in the Grand Canyon around A.D. 1200–1400 coincided with widespread stream entrenchment on the southern Colorado Plateau at about this same time (Hereford, Jacoby, and McCord 1996).

Another important key to deciphering the complex climate story surrounding the deposition and erosion of Holocene deposits in the inner canyon concerns the deposition of coarse-grained sediment from the side canyons. While numerous debris flows have occurred in the canyon during historical times, no major fan-forming debris-flow events have been documented that approach the magnitude of the prehistoric periods (Hereford, Thompson, Burke, and Fairley 1996). This implies that the climatic regime experienced in the region today may not be wholly analogous to conditions experienced by the prehistoric occupants of the Grand Canyon.

I. G. Questions

1. What do dendroclimatological records from the Grand Canyon region reveal about variability in annual rainfall and seasonal temperatures through time?
2. What do dendroclimatological records from the Grand Canyon region reveal about large-scale climatic-regime shifts through time (e.g., evidence of Pacific decadal oscillations)?
3. How do dendroclimatological records from the Grand Canyon region compare with those of the Flagstaff area?
4. What do the Holocene pack-rat middens reveal about climate change during the past 5,000 years, as reflected in the prehistoric vegetation of the river corridor?
5. What do pollen records trapped in silty alluvium and ancient cutoff-backwater areas reveal about the prehistoric climate of the region through time?

Data Needs:

- Continuous locally derived dendroclimatological records extending back 2,000± years
- Pollen and species-specific macrobotanical information from local (Grand Canyon) Holocene-age pack-rat middens
- Sequential data from pollen cores obtained from persistent backwater channels and other long-term ponded environments in and around the Grand Canyon

Approaches and Methodological Considerations

The utility and accuracy of paleoenvironmental indicators for reconstructing past climates are constrained by four factors: (1) the accuracy and precision with which the indicators are dated, (2) environmental sensitivity, (3) response time, and (4) the data's congruency with climate (Rose 1989). Some indicators, such as tree rings, have a high degree of temporal resolution, high environmental sensitivity (for certain species), rapid response time, and close congruency with climate. Pollen data, on the other hand, often have low temporal precision, less environmental sensitivity, slower response time, and only moderate congruency with climate. However, pollen data can reveal changes in the predominance of specific species that are not recorded in other mediums, and they are useful for revealing major shifts in regionally distributed arboreal species over time. When paired with other data sets, such as pack-rat middens, pollen data can provide a much more robust reconstruction of climate change over time.

The Colorado River primarily derives its water from snowmelt in the headwaters of the Rocky Mountains, whereas sediment load is mainly derived from tributaries of the Colorado Plateau (Andrews 1991). Therefore, the climatic regimes of both regions potentially influence rates of alluviation in the Grand Canyon. In order to understand these relationships, paleoclimatic data from both the immediate environs of the Grand Canyon, as well as from the Rocky Mountains are needed. Petersen's (1981) paleoclimatic research in the La Plata Mountains and the Dolores, Colorado, region may provide a suitable proxy for the Rocky Mountains, and Salzer's (2000a, 2000b) study of temperature and precipitation data from the San Francisco Peaks provides a more local record, but much more detailed dendroclimatological information is needed from the immediate vicinity of the Grand Canyon. Obtaining these data will require coring numerous old-growth pines and beams from archaeological sites in and around the Grand Canyon.

I. H. Ecological Changes in the River Corridor through Time

Moving beyond geomorphological studies and climatic reconstruction, we need to be able to reconstruct the prehistoric biotic environment of the river corridor prior to and during the span of human occupation. Webb's (1996) creative analysis of historical photographs reveals both considerable stability and longevity in plant communities within the river corridor, but at the same time, he demonstrates how some plant communities have been considerably altered as a result of climatic fluctuations involving relatively brief but exceptionally cold weather events (Webb 1996:87–98).

We know that the presence and operation of Glen Canyon Dam have profoundly affected current vegetation communities adjacent to the river (Turner and Karpiscak 1980). If there were extended periods of low flows or other variations in the hydrologic regime during prehistoric times due to prolonged drought, then similar sorts of shifts in riparian plant communities and associated animal species presumably would have occurred.

In addition to dam building, other human activities have had profound and, as yet, not fully understood effects on vegetation in the Grand Canyon. Historical-period grazing by introduced species such as domestic sheep, cows, and burros has dramatically affected plant communities above the riparian zone (Webb 1996:69–86). Fires, whether deliberately or accidentally set by humans, have altered the inner-canyon ecology in ways yet to be studied. The possible effects of these and other human-caused disturbance processes on the prehistoric landscape need to be taken into account when interpreting the archaeological remains in the river corridor.

I. H. Questions

1. What do pack-rat middens reveal about changes in the Holocene vegetation community of the river corridor through time?
2. What do pack-rat middens found in proximity of specific archaeological sites reveal about the prehistoric vegetation community in the immediate area, relative to the river corridor as a whole?
3. What do pollen records trapped in silty alluvium and ancient cutoff-backwater areas reveal about the prehistoric vegetation of the region through time?
4. How do the distributions and densities of individual plant species in the river corridor today compare with those in the past?

5. Can we detect changes in the vegetation of the river corridor over time (i.e., the introduction of economically valuable species, increases in weedy species, or noticeable decreases in potentially important economic species such as Sporobolus sp.) that may be indicative of anthropogenic influences?
6. What do archaeologically derived faunal data (e.g., fish bones, bird bones, and other faunal remains) reveal about the prehistoric ecology of the river corridor when compared with that of today?

Data Needs:

- Holocene-age pack-rat-midden data from the immediate vicinity of the river corridor and in close proximity to archaeological sites
- Pollen cores from ponded environments within the river corridor
- Distributional data and relative abundance measurements on specific faunal and floral species obtained from numerous archaeological sites and other stratified contexts throughout the river corridor

Approaches and Methodological Considerations

Pack-rat-midden studies by Cole (1981, 1982, 1990), Mead (1983), and Phillips (1977) provide us with fairly robust information about the different vegetation associations that were present in the late Pleistocene compared with today. However, information from the middle to late Holocene era is far less abundant. Additional midden studies that focus explicitly on the last 5,000 years are needed. Holocene middens located near the river should be identified and systematically sampled in order to provide paleobotanical data specific to the river corridor.

Pollen studies provide another potential avenue for reconstructing the paleobotanical environment of the Grand Canyon on a regional scale. This data source is not sufficiently fine grained to allow for paleoenvironmental reconstruction specific to the river corridor or to a specific interval of time, but it does allow for meaningful comparisons across the region as a whole during the past several thousand years.

Alcoze and Hurteau (2001) offer another potential approach for reconstructing reference ecosystems within the Grand Canyon region. Through a careful and comprehensive assessment of archaeological-data sources and subsequent comparisons with modern botanical and faunal assemblages, they have demonstrated changes over time in the vegetational composition of the Grand Canyon's regional ecosystem. A similar approach could potentially be applied to the river corridor specifically.

II. The People

Most cultural historical reconstructions of the Grand Canyon region present a story of people with different backgrounds and traditions moving into and then out of the Grand Canyon region, mainly in response to changing environmental conditions (e.g., Euler et al. 1979; Schwartz 1966b). Although there is some disagreement among archaeologists about who these people were, where they came from, and what became of them after they disappeared from the Grand Canyon archaeological record, there is general consensus that the Grand Canyon was populated by waves of migrants moving into the region from both the east and the west, residing in the region for a period of time, and then moving on to other destinations. In this respect, at least, Native American traditional understanding of the past and archaeological perspectives are fairly closely aligned. Divergences in perspectives arise when archaeologists attempt to pin cultural labels on the various archaeological manifestations, such as calling the Cohonina "Patayan" and thereby discounting any connection with ancestral Puebloans or historical Havasupai, or labeling the artifacts of ancestral Pai people as "Cerbat." A divergence in viewpoints also stems from the way that archaeologists conceptualize prehistoric people and cultures as static entities responding in tandem to environmental change, rather than as dynamic and diverse cultures composed of individuals exercising a variety of options and choices and taking actions for reasons that may have little or nothing to do with environmental factors.

Although most Native American cultural scholars are not overly concerned with the specific timing of events in the past, this is of fundamental interest to most archaeological research. How old is this or that? When did a particular technological innovation come into existence? In landscape archaeology (and, indeed, in archaeological research in general), the need to place things in chronological order is driven by more than a desire to know when something happened. Chronological ordering is a fundamental means of sorting out the archaeological record and identifying and separating those pieces of the story that were created contemporaneously from those that preceded or succeeded them. For landscape archaeology, this is a particularly crucial issue, because an underlying premise of the landscape approach is that past human activities and environmental processes created the stage for and influenced the choices of later occupants.

In addition to chronology, three other issues are of key importance to understanding the cultural landscape of the river corridor: cultural identities, subsistence and settlement strategies, and exchange. The issue of cultural identities is important because the nature of interactions between different cultural groups—with different origins, ideas, technology, and access to resources—may form the foundation for later and entirely new patterns observed in the archaeological record. How do we distinguish one cultural group from another? Are the artifacts and patterns that we have traditionally used to identify "archaeological cultures," such as pottery and house forms, meaningful as indicators of cultural or ethnic identities and, if so, in what respects? What other ways might be explored to help distinguish cultural and social entities in the archaeological record? Variations and similarities in subsistence and settlement patterns, both within groups and between groups and between periods of time, are, of course, critical factors shaping the cultural landscape of the Grand Canyon. The issue of exchange allows us to understand not only the scope of prehistoric economic systems, but also the connections between various outlying regions and the inhabitants of the river corridor. All of these different aspects together help define and characterize the human agents shaping and influencing the river-corridor landscape we see today.

II. A. Chronology

Although chronology is not generally considered to be an important attribute of traditional Native American histories (Basso 1996:31; Nabokov 2002:70–72), it serves as the cornerstone of archaeological inquiry. Whether archaeological research takes the form of reconstructing culture history, exploring patterns of cultural evolution, determining cultural processes that operated in the past, or sorting out the formation of various landmarks that give rise to cultural landscapes, a chronological framework is necessary in order to place sites and other kinds of archaeological remains in their appropriate temporal context. However, it is essential that appropriate dating techniques be selected to address specific chronological-research issues. The inappropriate application and interpretation of dating techniques has led to some questionable conclusions about Grand Canyon prehistory (see the Approaches and Methodological Considerations discussion, below). Keeping methodological caveats in mind, a variety of appropriate dating methods could be applied toward addressing the following research questions in the Grand Canyon.

II. A. Questions

1. What is the earliest use of the Grand Canyon by humans?
2. When do maize, beans, cotton, and other domesticates first appear in the Grand Canyon?
3. How does the timing of the introduction of ceramic technology compare with the initial recognition of Cohonina and Puebloan ceramics in the river corridor?
4. What are the temporal relationships of Cohonina and Kayenta pottery distributions in the Grand Canyon?
5. Does the end of Puebloan occupation postdate the proposed timing of abandonment based on cross-dated ceramics?
6. Does the proposed date of A.D. 1250–1300 for the arrival of ancestral Pai and Paiutes in the Grand Canyon hold up under close scrutiny?
7. What is the earliest recognizable Navajo use of the inner canyon?
8. Do sites with "pure" Cohonina ceramic assemblages consistently predate Puebloan remains in the river corridor?

Beyond these simplistic kinds of questions, however, we need much better chronological control to understand the timing of processes and cultural transitions within the river corridor. For example:

9. Can shifts in Puebloan settlement patterns and exchange be identified and correlated with specific intervals within the Pueblo II period, as Schwartz et al. (1980) maintained?
10. Can we detect potentially significant changes in ancestral Pai and Southern Paiute subsistence organization during the 600+ years of late prehistoric/protohistoric occupation that may correlate with the changing nature of social relations beyond the rim (i.e., the introduction of Euroamerican trade goods, predation by Spanish slave raiders, the arrival of Mormons and American military)?

Questions regarding our assumptions about the ages of specific artifacts that are considered to be temporally diagnostic in regions outside of the Grand Canyon river corridor also deserve consideration. As dates are collected from various contexts in the river corridor (especially dendrochronological data), it may be possible to develop local ceramic and projectile-point chronologies that are more accurate than those imported from surrounding regions. For example:

11. Are the temporal ranges of Gypsum and San Pedro points distinct or overlapping?
12. Are the dates assigned to temporally diagnostic Puebloan ceramics in the Kayenta region applicable to the Grand Canyon?

13. Do Desert Side-notched points consistently occur in post–A.D. 1300 contexts, or do they show up in earlier contexts within the Grand Canyon?

Data Needs (numbers correlate with previous questions):

1. Radiocarbon dates from well-defined cultural contexts in Holocene deposits predating 3500 B.P. and obsidian-hydration dates on artifacts from pre–3500 B.P. cultural deposits
2. Direct radiocarbon dates on cultigens or unequivocally associated perishable artifacts, preferably from food-production sites (e.g., fields)
3. Radiocarbon dates from annual plants and perishable items found in direct association with early ceramic remains, and archaeomagnetic dating of kilns
4. Dendrochronological dates and carefully selected radiocarbon dates from single-component sites dominated by San Francisco Mountain Gray Wares
5. Dendrochronological dates on structures from sites containing Flagstaff Black-on-white or other Pueblo III ceramic types, and radiocarbon dates on annual-plant remains associated with these sites
6. Dendrochronological dates on Pueblo III and Pueblo IV structures, and radiocarbon dates on diagnostic perishable items or culturally associated plant materials other than wood, preferably from deeply stratified sheltered contexts
7. Dendrochronological dates or very carefully selected radiocarbon dates in association with diagnostic Navajo artifacts
8. Dendrochronological dates or very carefully selected radiocarbon dates from both single-component and multicomponent (stratified) sites containing San Francisco Mountain Gray Wares and Tusayan White and Gray Wares

9.–13. Dendrochronological dates and direct dates on perishable artifacts associated with temporally diagnostic artifacts from as many sites as possible

Approaches and Methodological Considerations

Temporal frameworks applied to Grand Canyon prehistory have relied on two primary sources of chronological information: radiocarbon dating and ceramic cross-dating. Each of these methods has value, but their value varies in relation to the types of materials and contexts being dated, as well as the specific research questions that are being asked. For example, during Hereford's geoarchaeological-research work, it was necessary to draw on as many different sources of chronometric data as possible to create the large-scale maps required for the project. Hereford relied on radiocarbon dating of both cultural and noncultural organic materials, dendrochronological dating of living trees and buried stumps, ceramic cross-dating, historical-period-artifact dating, dissolution pitting, desert-varnish formation and other weathering processes exhibited by boulders, and historical photographs to establish the ages of various depositional units. The use of a broad array of dating techniques was appropriate in Hereford's situation, because no prior alluvial chronology had been established, and materials suitable for dating were widely scattered over the landscape.

On the other hand, many instances exist where only one or a few dating techniques can be appropriately applied, depending on the specific research issue or the context being examined. For example, if we want to establish the sequence of construction events at a particular pueblo, radiocarbon dating will not be able to provide the level of resolution necessary to address this problem.

During the past decade, archaeologists and other researchers working in the Grand Canyon have tended to collect radiocarbon samples indiscriminately, without first formulating specific questions that might be answered with radiocarbon dating or carefully considering the implications of the specific contexts from which the samples were derived. For example, Davis et al. (2000:791) obtained radiocarbon dates of 1420 ± 90 B.P. (cal A.D. 560–580) and 1310 ± 60 B.P. (cal A.D. 660–780) on "plant residue" from a test pit containing corn and cotton pollen in a fluvial deposit at Nankoweap and used it as the basis for claiming that people were growing corn and cotton on the Nankoweap delta more than 1,200 years ago. Although this may in fact be true, the evidence they relied on was unsuited for making this claim because of (1) the lack of identification of the dated material, (2) the fact that the sample was recovered from a context that was subject to extensive reworking, and (3) the lack of careful definition of the cultural context of the date or associated materials. Davis et al. (2000) also recovered several radiocarbon dates from a fluvial deposit near Comanche Creek, two of which bracketed a layer containing corn pollen. They subsequently relied on this evidence to advance the claim that horticulture was being practiced in Grand Canyon by 1300 B.C. If valid, these data would be contemporaneous with the earliest evidence for corn agriculture anywhere on the Colorado Plateau. The fact that the dated material was never identified or that corn pollen is highly mobile and can migrate through sediment and be transported long distances by wind or water action were never considered in their discussion. Archaeologists concerned with documenting the transition to agriculture on the Colorado Plateau consider these dates to be unreliable for the reasons cited above.

Geib, Matson, Smiley, and others maintain that only direct dates on cultigens or on annual plants directly associated with deposits containing cultigens can be accepted as evidence for early agriculture in the American Southwest (Phil R. Geib, personal communication 2000; R. G. Matson, personal communication 2001; Smiley 1994:183–184).

Several references to the "old wood issue" have been made in preceding chapters in which the interpretation or validity of radiocarbon dates are an issue. The old wood problem is a serious concern when interpreting radiocarbon evidence derived from wood charcoal, especially in the Grand Canyon, where prehistoric and historical-period peoples presumably relied on driftwood for fuel and made use of the abundant mesquites that grow along the river. A study by Ferguson (1971) examined the ages of pinyon driftwood in the Grand Canyon river corridor by dendrochronologically dating specimens found along the current riverbanks. A sample of 21 pinyon specimens produced dates ranging in age from A.D. 1291 to 1958 on the outside rings. The average outside-ring date for these 21 specimens combined is approximately A.D. 1792. The innermost rings on these same specimens ranged in age between A.D. 1011 and 1893, with an average internal-ring date of ca. A.D. 1558. Ferguson (1971:364) concluded that a fire made out of trimmings from these samples could have produced radiocarbon dates spanning five or six centuries. Considering the likelihood that the outer rings would have been destroyed by fire, radiocarbon dates derived from burnt pine driftwood are probably going to be at least two centuries, and probably three or four centuries, older than the burning event.

Although it grows locally, and is therefore not subject to extended transport times, mesquite wood can also produce very old dates because of the longevity of the species. In an attempt to establish a minimum age on a terrace surface, Hereford radiocarbon-dated the pith of a large, dead branch on a barely living mesquite tree (one branch still exhibited green growth). It yielded an approximate 2-sigma calibrated date of cal A.D. 1240–1340 (Hereford et al. 1993:10). Cottonwood driftwood, on the other hand, would probably produce considerably younger dates on average, because the trees do not grow much older than 100 years and the driftwood wood tends to decay faster than pine species.

Given these limitations, it obvious that radiocarbon dating involving wood charcoal is most usefully applied in situations where the age of a site or the deposits within the site are either unknown or require independent verification. Proper interpretation of these dates requires knowledge of the species being dated and a clear understanding of where the specimens came from and the processes that may have acted upon them over time. It is preferable, whenever possible, to obtain radiocarbon dates from annual specimens, such as grasses, cultigens, or leaves, rather than long-lived species, such as pinyon or mesquite. When dating wood charcoal is the only option, at least two, and preferably three, dates should be run on samples from a single feature, and the samples should preferably be selected from the outermost rings. Although the use of these techniques will not eliminate distortions caused by old wood, they will help reduce the number of spurious dates that are now starting to clutter the archaeological record from the Grand Canyon.

Although radiocarbon dating can be a very useful tool under certain circumstances, equally useful dating tools are available and are often more appropriate in other circumstances. Ceramic cross-dating has been widely applied throughout the canyon, and although this is a highly efficient and inexpensive method of dating, it too has obvious limitations. In situations where diagnostic ceramics are sparse, for example, ceramics can provide only a general time assignment. Even when diagnostic ceramics are abundant, archaeologists must be cautious about assuming that these ceramics tell the entire chronological story. If earlier ceramic assemblages are present, or if the site overlies aceramic deposits, these older materials are likely to be overshadowed by the later diagnostic ceramic remains. Even in obvious single-component contexts, we must exercise caution in assuming that the cross-dates on ceramics from other regions of the Southwest are wholly applicable to the Grand Canyon. Independent verification of this assumption is necessary through the establishment of a local ceramic chronology. In all cases, close attention must be paid to the subsurface archaeological stratigraphy to establish the age of a site, particularly in the dynamic depositional environment of the Grand Canyon river corridor.

Cross-dating of diagnostic lithic artifacts is another potentially useful dating tool, but one that is currently limited by the paucity of locally excavated, well-dated, stratified sites. Currently, we are forced to rely on dates from projectile points derived from excavated localities elsewhere on the Colorado Plateau, some (e.g., Sudden Shelter) located at a considerable distance from the Grand Canyon. While projectile-point cross-dating can be used as a preliminary assessment technique, it should be backed up with well-controlled, carefully selected radiocarbon dates or, better yet, dendrochronological dates, if possible.

Obsidian hydration is another technique that has seen only limited application in the Grand Canyon region (e.g., Schroedl 1988), and archaeomagnetic dating has not been attempted at all. Although both techniques are still being refined, they offer potential avenues for acquiring chronological data to supplement or verify dates obtained by other means, especially when diagnostic artifacts are sparse or lacking. Obsidian-hydration dating has the potential to become a particularly valuable and versatile dating technique in the Grand Canyon region, especially on the canyon rims, where surface scatters containing this material are relatively abundant, but stratified sites containing datable features are rare.

Dendrochronological dating is one highly accurate technique that has been only sparsely applied to archaeological sites in the canyon. Under the right circumstances (e.g., numerous structural beams or posts preserved in a structure), it can narrow the date of construction down to one or a few calendar years. Certainly, dendrochronological dating would be a much more appropriate means of determining whether the granaries at Nankoweap were constructed during Basketmaker III times, as hypothesized by Davis et al. (2000:796), than the radiocarbon evidence they relied on.

II. B. Cultural Identity

The scope and nature of cultural interactions in the Grand Canyon have been long-standing research concerns for archaeologists, yet we have made relatively little progress in moving beyond rigid culture-area concepts in our interpretations of cross-cultural interactions in the region. For example, the archaeological literature is replete with references to Cohonina and Anasazi (ancestral Puebloan) occupation of the Grand Canyon, yet we still have little understanding of the fundamental nature of the relationship between these two supposedly distinct cultural groups. A primary obstacle to pursuing this line of inquiry may be archaeologists' basic and unquestioned conception of these two groups as distinct cultural entities, with presumably different origins and traditions. To what extent does the archaeological data actually support or refute this concept? Are there other possible ways of interpreting the archaeological evidence, and, if so, what types of additional evidence do we need to develop alternative models?

The debate between Schwartz and Euler exemplifies the tautological nature of past debates. Schwartz maintained for years (1955, 1956, 1969, 1983) that there was a direct ancestral link between the Havasupai and Cohonina, a perspective that Euler (1958, 1975; see also Dobyns and Euler 1960) adamantly disputed. To a large extent, the debate hinged on Euler's identification of Tizon Brown Ware as being diagnostic of "Cerbat culture" (ancestral Pai), whereas San Francisco Mountain Gray Ware, a paddle-and-anvil gray ware, was diagnostic of Cohonina. San Francisco Mountain Gray Ware ceases to be recognizable in the archaeological record by about A.D. 1150, more or less coincident with the disappearance of Puebloan ceramics. Thereafter, oxidized paddle-and-anvil brown ware, sometimes in association with Jeddito Yellow Ware, dominates the archaeological record. Although initially uncertain about the temporal extent of the break between Cohonina and Cerbat, Euler later maintained that there was a hiatus of approximately 150 years (between A.D. 1150 and 1300) (Euler 1981b:169). Subsequent researchers have documented breaks in the archaeological record between Cohonina and Cerbat deposits (Bair 1994b; Jones 1986), but, in many cases, the evidence for discontinuity between occupations has been ambiguous (Jones 1986; Linford 1979). Fundamentally, the debate ultimately hinges on whether the difference between San Francisco Mountain Gray Ware and Cerbat Brown Ware represents technological evolution or the appearance of an entirely different cultural tradition. Is there any possibility that these differences in ceramics represent nothing more than a shift in technology, akin to the shift from glassware containers in the 1860s to Tupperware in the 1960s? Schwartz subsequently abandoned his position on this issue, but other researchers have taken up the cause (e.g., Simonis 2001; cf. Bair 1994a:275). How do we move beyond the impasse?

To begin, we could take a closer look at the Native American perspectives on these issues. For example, the Hopi maintain that at least some Hopi clans have a direct cultural affiliation with the Cohonina (Walter Humana, personal communication 1992). Likewise, the Havasupai continue to assert that they have a direct ancestral link with the Cohonina remains found throughout their historical territory (Roland Manakaja, personal communication 1996). How can this be possible, given the supposedly distinct and different origins, traditions, and languages of these two modern-day tribal entities? Rather than summarily dismissing these conflicting claims, archaeologists could profitably reexamine the archaeological evidence in terms of these traditional Native American points of view. What kinds of material cultural traits do modern Native Americans consider to be culturally diagnostic? If some Hopi clans are descended from the archaeological Cohonina culture, how does this change our previous dichotomous perspective of Cohonina and "Anasazi" in Grand Canyon prehistory?

Somewhat different, but related, debates concern the nature of prehistoric Pai and Paiute interactions along the Colorado River. Relying primarily on ceramic evidence, archaeologists working on the 1990–1991 corridor survey identified several sites as either Pai or Paiute, and many as some combination thereof, based on the presence of diagnostic ceramics. Frequently, Pai and Paiute ceramics were located on opposite sides of the river from where the ethnographic literature would predict. Are the occupations truly contemporaneous? If so, what was the nature of the relationship between these two groups? The ethnographic and historical literature provides apparently contradictory accounts about the nature of historical-period Pai and Paiute interactions (e.g., Spier 1928:251, 360). From a different perspective, however, the ethnographic literature demonstrates that cultural relations within the river corridor were not static and unchanging, but complex and highly variable. In what other ways can the ethnographic literature inform future researchers about the archaeology in the river corridor, as well as about the real-life interactions between the various groups?

Previous studies of Grand Canyon prehistory have tended to conceptualize constellations of archaeological traits as static and inherently meaningful cultural entities. Thus, the Cohonina, Kayenta, and Virgin Anasazi are discussed by many archaeologists as though they were "prehistoric tribes." Unlike real human cultures, however, these "tribes" are conceived of as having distinct origins, and although these "tribes" are conceptualized as competing for resources or interacting with each other in various ways, they consistently seem to maintain entirely separate identities that, in some cases, are presumed to continue to exist up to the present. Thus, we have created a cultural-historical fiction in which the Cohonina supposedly "disappeared," whereas the Kayenta Anasazi "became" the Hopi, and the Cerbat evolved into the Hualapai and Havasupai. Whiting (1958:59) recognized the fundamental problem with this way of thinking decades ago when he noted, "The error in this thinking lies in the biological evolution pattern of our thought. Cultures, unlike species, have multiple origins. Thus it is clear that while Hopi culture may be a direct descendant of Kayenta, many other cultures have also made their contributions, both in late prehistoric and historic times."

More recently, archaeologists have begun to question the whole notion of archaeologically defined cultures (e.g., Clark 1988; Dongoske et al. 1997; Shennan 1989). As Shennan (1989:13) notes, "archaeological distributions [of material traits] are the product of a variety of different processes. . . . If we examine the distribution of individual types of archaeological material, especially if we use quantitative rather than mere presence-absence information, we find not neatly bounded entities but an enormous variety of cross-cutting patterns." Shennan (1989:13) further observes that previous archaeologists attempted "to remove the untidiness in the crosscutting distributions, rather than taking the more radical step of recognizing that this untidiness is, in fact, the essence of the situation, arising from the fact that there are no such entities as 'cultures,' simply the contingent interrelations of different distributions produced by different factors."

Be this as it may, regional patterns or styles of material culture are nevertheless recognizable in the archaeological record, and although the processes that result in their continuing transmittal ("traditions") may not necessarily stem from a need to maintain a separate social identity from neighboring groups, stylistic traditions are perpetuated, to some extent, because the tried-and-true way has been found to work. As Shennan (1989:22) points out, "this is because in a context where culture is much more important than genes from the selection point of view, it will usually be advantageous to take [*sic*] decisions based not on individual learning, but on imitation of existing culturally transmitted practices, especially those that are most frequent." Furthermore, humans tend to want to imitate "those who appear particularly successful in their society, not just in the specific aspects that are relevant to their success, but also in other aspects of their behavior and appearance. This would lead to the appearance of areas of similarity."

Where does all of this leave us in terms of Grand Canyon prehistory? First, it suggests that we need to discontinue the practice of equating a constellation of traits with prehistoric tribes or "cultures." This is not to say that terms such as Cohonina and Kayenta are not useful and should not continue to be used to refer to particular, spatially restricted constellations of traits, but rather that we should avoid falling into the trap of assuming that there are one-on-one correlations between these archaeological groupings and prehistoric cultural units.

However, the reality is that we have never relied on groupings of cultural traits to define cultural units in the Grand Canyon area. Rather, the emphasis has been almost exclusively on one trait—pottery. What if we had used another artifact type—for example, basketry—to separate cultural groups? Would the patterns observed on the landscape and inferences made have been the same? This raises the issue of what detailed studies of other cultural materials may be able to tell us about past connections between people and places. In addition to focusing additional attention on specific artifact categories such as basketry, sandals, and lithics, we may want to look closely at the distributions of specific architectural techniques, house plans, overall site layouts, and broad settlement patterns across time and space.

II. B. Questions

1. Do the archaeological traditions previously identified in the Grand Canyon region have validity as spatially and/or temporally discrete "cultural units" when other aspects of material culture besides pottery are considered? In other words, is there congruence between the association of specific pottery wares and other aspects of material culture? Can different kinds of cultural alignments (links between technological traditions) be identified on the basis of lithics, perishable technology, architecture, or rock-art styles? If so, what are they?
2. Is there a single, essentially uniform Early Formative plain gray ware tradition that later (post–A.D. 700) gives rise to regionally distinctive ceramic traditions? If so, does regional resource competition account for the development of these distinct regional styles (à la Weissner's hypothesis [1982, 1983, 1984]), or do other factors (i.e., regional isolation) contribute to the emergence of distinct regional styles?
3. Does the distinction between Puebloan and Cohonina lose clarity over time, or does a recognizable (spatial) distinction persist up through the twelfth century A.D.? If there are differences over time, for example, between the Early (pre–A.D. 950) and Late (A.D. 950–1200) Formative periods, what processes might account for this change, and how might we recognize these processes in the archaeological record?
4. What *stylistic* characteristics distinguish the Virgin and Kayenta ceramic traditions?
5. Can Virgin and Kayenta sites within the river corridor be consistently distinguished on the basis of material culture other than pottery? Is the distinction between Virgin and Kayenta temporally limited?
6. Do the attributes used to distinguish Southern Paiute and ancestral Pai sites have discrete distributions in time and space? Do these traditions show any changes in material culture through time? Do any changes correlate with historical events or influences?
7. Can lithics offer an alternative to pottery for distinguishing sites of historical-period Pai, Paiute, Hopi, Zuni, and Navajo affiliation? What other material attributes may be useful in distinguishing late prehistoric, protohistoric, and historical-period sites in the absence of pottery?

Data Needs (numbers correlate with previous questions):

1. Distributional data, at both the intrasite and intersite level, derived from spatially and temporally controlled analyses of lithic assemblages, perishables, architecture, and rock art
2. Comparative data on vessel form and design elements of Early Formative gray wares on a regional scale
3. Data derived from temporally and spatially controlled studies of Cohonina versus Puebloan attributes over time, including Sullivan's (1995a, 1997) proposed settlement distinctions
4. Comparative data on vessel forms and decorative styles of Puebloan pottery types from Early and Late Formative types, including a reassessment of Schwartz et al.'s (1979, 1980) Virgin ceramics from inner-canyon sites
5. Comparative data from contemporary middle Pueblo II sites pertaining to architectural attributes, subsistence, flaked and ground stone, and ecological/geomorphological settings
6. Objective, attribute-specific analytical data from brown wares, without regard to spatial or temporal provenience; temporal seriation of diagnostic elements; comparative data from temporally similar Pai and Paiutes sites, as well as from sites of obviously different time periods
7. Analytical data from multiple, single-component lithic assemblages, characterized in terms of assemblage "signature" (i.e., principal lithic-reduction strategy, material usage, tool types, heat treatment, and other potentially meaningful categories)
8. Comparative data on late prehistoric, protohistoric, and ethnographic basketry/textile assemblages in terms of materials, techniques, style of manufacture, functional types, artistic design, and so on
9. Ethnographic interview data from diverse tribes concerning their views on the symbolic value of various material culture traits

Approaches and Methodological Considerations

For starters, we need to take a closer look at other classes of material culture, besides pottery, to develop a more realistic and comprehensive understanding of how neighboring "archaeological cultures" do or do not differ from one another in terms of material attributes. Basketry and other perishable textiles have proven to be exceptionally sensitive and useful indicators of shared cultural tradition (e.g., Adovasio 1980, 1986; Adovasio and Hyland 1997), yet scarcely any attention has been paid to this class of artifacts by previous Grand Canyon archaeologists, except in a very cursory fashion (e.g., Fairley 1997b). Sandals, a relatively common perishable item in Grand Canyon shelter sites (e.g., AZ A:16:1, AZ A:16:3, AZ B:10:230), have been shown to have spatial patterning and considerable interpretive value (Deegan 1995; Geib 2000). To date, however, no attempts have been made to analyze these Grand Canyon artifacts systematically in terms of their age, materials, and precise methods of manufacture.

Although less sensitive as cultural markers than ceramics or textiles, lithics provide another potential avenue for differentiating cultural groups. Much could be learned about cultural traditions and behaviors from a closer examination of the lithic assemblages from spatially restricted, single-component sites. Analysis of debitage and tools from multicomponent sites will be useful only if the site is excavated in a manner that allows for the separation of materials based on natural occupation levels. The recent excavations at the Indian Canyon site (Hubbard et al. 2001) offer a prime example of how a poorly conceived excavation strategy can produce a minimal amount of useful information, despite a careful and conscientious lithic analysis (Berg 2001).

Once technological and stylistic data have been gathered from diverse categories of material culture, GIS technology offers a means of sorting and analyzing these data to reveal distributional patterns in time and space. GIS has not yet been applied as an analytical tool for archaeological research in the Grand Canyon region.

An entirely different approach to elucidating meaningful prehistoric cultural identity categories would involve interviewing tribal members to (1) understand what oral traditions may have to say about the nature of "clans" and other cultural groups in prehistory, (2) gain a better understanding of how modern cultural groups conceptualize themselves in relation to other cultures, and (3) understand how aspects of material culture may or may not be useful for signifying group membership. For example, do the technological and stylistic traditions of modern Pai and Paiute basketmakers show consistent intragroup similarities or intergroup differences that are readily recognizable using traditional archaeological-analysis techniques?

Incorporating oral traditions into the formulation of this research design does not mean that we are proposing a research program focused on demonstrating or discounting the scientific validity of traditional Native American perspectives (cf. Mason 2000). Rather, oral history provides an alternative means of conceptualizing the past (Echo-Hawk 2000), which will hopefully allow us to move beyond previous, unproductive avenues of inquiry and develop new models for structuring future investigations of the archaeological record in the Grand Canyon. At the same time, the incorporation of traditional knowledge and ethnographic information forces archaeologists to reevaluate some of their preconceived ideas about how cultures evolve, function, and change over time, and about the role that material culture plays in these processes.

II. C. Subsistence and Settlement Issues

The prehistoric and historical-period subsistence economies expressed in the humanly modified landscape of the inner Grand Canyon cannot be understood apart from the regional context in which they occurred. Almost every previous researcher working in the Grand Canyon has examined the subsistence economy of inner-canyon settlements in terms of their linkages to a much wider geographic area (e.g., Euler and Chandler 1978; Fairley 1989c; Huffman 1993; Schwartz et al. 1980, 1981). The most popular model is one that conceives of the inner canyon as a specialized procurement or food-production zone, bounded by a series of complementary resource zones defined by elevationally determined environmental variables such as mean temperature, rainfall, and associated plant communities. A high degree of mobility is an intrinsic assumption of this model, as it presupposes that human beings were constantly moving between upland and lowland settings in their quest to procure and produce subsistence resources (Huffman 1993).

Although environmental variability is certainly important for understanding past economic strategies in the Grand Canyon, we need to consider other possible scenarios. Sullivan (1996, 1997) has been the chief architect and advocate of an alternative model, which posits an essentially sedentary residential system during the Formative period, with communities subsisting primarily on nonagricultural resources in the Upper Basin interacting and exchanging goods with agriculturally dependent sedentary populations, some of whom presumably were based within the canyon. More recently, Downum (2001) has suggested that it is time to revisit the old inner-canyon–upland subsistence model in light of the numerous late Pueblo II–early Pueblo III "fort-like" features found along the north and south rims of the Grand Canyon. If occupants of the uplands were the same as those using the inner canyon, why would these apparently defensive features be necessary?

As discussed in the preceding chapter, current conceptions of late prehistoric and protohistoric settlement-subsistence strategies in the Grand Canyon region are heavily influenced by ethnographic accounts by Kelly (1964), Kroeber (1935), and others. To what extent are these models actually supported by archaeological evidence, however? Rather than continue to assume that sites were occupied seasonally or for agricultural purposes, we need to take a more empirical approach and specifically look for evidence relating to seasonality of use and agricultural production in the archaeological record.

II. C. Questions

1. Can seasonality be determined from the archaeological record of inner-canyon sites? If so, which models of seasonal-use patterns for the Formative and late prehistoric/protohistoric occupations of the Grand Canyon are supported by archaeological evidence?
2. Can changes in settlement-subsistence organization be documented through time within a given period (e.g., Early Formative, Late Formative)?
3. Can changes in settlement-subsistence organization be correlated with local or regional environmental changes (i.e., episodes of erosion, increased variability in tree-ring indexes) and, if so, in what ways?

Data Needs:

- Macrobotantical and pollen data, preferably from single-component sites, emphasizing the presence/absence and relative abundance of seasonally specific plants and plant parts (e.g., fruits, flowers, mature or immature seeds)
- Regional data on artifact assemblages, emphasizing functional aspects
- Regional comparisons of architectural and site-layout data from specific time periods
- Temporally controlled settlement data correlated with dendroclimatological and geomorphological data

Approaches and Methodological Considerations

Establishing empirical evidence of seasonality must begin with a close analysis of the paleobotanical remains from archaeological contexts. For example, rather than simply identifying *Opuntia* sp., analysts need to identify the specific parts of the prickly pear whenever possible, for what they might tell us about seasons of use. The recovery of *Opuntia* fruit parts, for example, would imply a late-summer–fall use, whereas the occurrence of pads may not be indicative of a particular season. Hutira's (1986) analysis of plant remains from several river-corridor sites serves as a useful starting point and provides a helpful example of this approach.

A reexamination of traditional subsistence-settlement models entails not only looking at the sites where resources were consumed but, more important, looking at the locations where resources were produced (Sullivan 1996). These latter sites may conform to our notions of "limited-activity areas," or they may in fact be largely devoid of material remains. Agricultural fields, for example, may only be recognizable on the basis of soil chemistry and pollen signatures, rather than by the presence of checkdams or hoes. A program of soil sampling throughout the river corridor could help to identify potentially suitable agricultural soils, which could then be analyzed for pollen evidence or chemical signatures indicative of agricultural practices. Analysis of carbonized layers within the river-corridor alluvium is also needed to identify whether field stubble was being burned, as Davis et al. (2000) hypothesized, or whether perhaps other nonagricultural vegetation was being burned, possibly to improve plant productivity (e.g., Sullivan 1996).

Finally, detailed analyses of artifact assemblages from various contexts within the river corridor and adjacent upland zones are needed. Are the assemblages from contemporaneous time periods similar in upland and river-bottom settings, or are there patterned differences that could indicate differences in seasonal-use patterns? Sullivan (1995a) has successfully used variability of surface assemblages to conclude that Cohonina and Anasazi were organized differently to exploit the same environment. Surface assemblages from the river corridor may not be as useful for this purpose because of the presence of shifting surface sand and the effects of fluvial processes on surface assemblages; however, artifact assemblages recovered from single-component whole-site contexts, or excavated from multicomponent sites in a manner that allows temporally distinct assemblages to be distinguished, could provide suitable data for future comparative purposes.

II. D. Socioeconomic Structure

An important aspect of the archaeological record worldwide is the apparent trend toward increasing social complexity over time. This trend is reflected in the apparent ranking of social units, notable differences in mortuary practices, and in the increasing scale and size of social interaction spheres. In some parts of the world, this trend culminates in the development of state-level societies, but in other areas, such as the American Southwest, the trend toward increasing social complexity is never played out to its full potential.

The degree to which native southwestern societies met the definition of "complex" has been a focus of intense discussion among southwestern archaeologists (Cordell and Gumerman 1989; Cordell and Plog 1979; Reid and Whittlesey 1990; Upham 1982). Embedded within these discussions are debates over scales of complexity and the nature of hierarchy in Precolumbian southwestern societies (e.g., Feinman et al. 2000). Meanwhile, a growing number of researchers wonder if the Southwest cultures may demonstrate an exception to previous models of how and why cultural complexity develops. Whereas the control of surplus goods permits concentration of wealth and power throughout most of the world (Johnson 1989:373), some scholars argue that the need to manage scarce or unpredictable resources in the American Southwest may have provided the principal stimulus for increasing complexity in social organization over time (Stone and Downum 1999).

The Grand Canyon region has largely been bypassed in all these previous discussions, mainly because of the widespread perception that the region is peripheral to events taking place in the Four Corners "heartland." The fact that Formative period indigenous development in the region was truncated around A.D. 1200–1220, with a drastic decrease in population apparently occurring at about this time, has also contributed to the dismissal of the Grand Canyon as an area for productive inquiry concerning the patterns and processes responsible for increasing social complexity over time. However, as Weintraub (2001) has recently pointed out, a growing body of evidence suggests that this process was underway in the Grand Canyon region just prior to the region's depopulation. As of yet, no one has explored the possible connections between the trend toward increasing complexity, intensification of resource-management strategies, and Puebloan emigration from the area.

II. D. Questions

1. What is the evidence for increasing differentiation of site types and activities through time?
2. Is there evidence for craft specialization and, if so, in what contexts does it occur?
3. Does the apparent increase in the size of sites from late Pueblo II to early Pueblo III in the Upper Basin (Weintraub 2001) have parallels in the river corridor?
4. If so, what do the artifacts and features associated with these larger sites tell us about the regional social organization at this time (i.e., evidence for decreasing or increasing exchange of luxury items, such as shell and turquoise; locally produced ceramics replacing trade wares; evidence of social stratification reflected in mortuary practices)?
5. Is there a trend toward increasing site size over time, and, if so, does it correlate with changes in subsistence practices and the intensification of resource-management strategies?
6. Where are the latest ancestral Puebloan sites in the river corridor located, and do these locations compare with post–A.D. 1150 settlement shifts above the canyon rim?

Data Needs (numbers correlate with previous questions):

1. Comparative data on site layouts and the presence of special-function features within and between site areas
2. Ceramic spalls, raw clay, polishing stones, special-function bone and stone tools (e.g., awls, drills, punches); large quantities of obsidian debitage or other relatively rare lithic materials; processed fibers and/or massive quantities of plant fiber in localized site areas; patterned distributions of these production areas at numerous sites; data on the relative abundance of turquoise, shell, onyx, and other luxury items over time

3.–6. Whole site plan layouts and architectural data from late–Pueblo II and early– to mid–Pueblo III sites and intrasite and intersite spatial data on luxury-item distributions

Approaches and Methodological Considerations

We need better chronological controls to begin to look at changes in social complexity over time. As noted under Section II. A., Chronology, dendrochronological dating of construction elements offers the best, most accurate means of establishing the time of construction at late–Pueblo II to early–Pueblo III sites. In the absence of dendrochronological evidence, ceramic cross-dating is probably the second most reliable and accurate means of establishing relative ages of sites within the river corridor. Under ideal circumstances (such as when annual-plant material was used in construction and subsequently preserved in stratified archaeological contexts), radiocarbon dates may offer a suitable means for establishing age control but, in general, radiocarbon dates will not be sufficiently fine grained to be useful for addressing this particular research issue.

We also need more thorough spatial analyses of individual habitation sites and artifact distributions, both within and between sites and at a regional level. Such analyses need to be conducted in a manner that will allow for the identification of specific-activity areas and will lead to descriptions of how sites were organized spatially through time. Within the river corridor, acquiring this type of data may necessitate clearing whole site areas or extensive contiguous areas within sites in order to identify buried structures and specialized intrasite activity loci.

The identification of specialized-production areas within sites does not necessarily require a whole-site excavation strategy. Jones (1986) identified a travertine-processing workshop at AZ C:13:10 and argued for the local production of ceramics at or near the site without excavating the entire site. However, she was unable to discuss how specialized-production activities may have been organized within the site—that is, was travertine-pendant production confined to a room specifically dedicated to that type of activity, or did it take place in a typical domestic structure housing a variety of other daily activities? Without having excavated the entire room and having other rooms to compare it with, and lacking comparative data from other sites, Jones was limited in her ability to make further inferences about the role of specialized-production activities at AZ C:13:10 or within the river corridor in general. Furthermore, although she identified the possibility that ceramics were being produced locally, not enough of AZ C:13:10 was exposed to determine if ceramic production was occurring at that site specifically. Sullivan (1995a:60) claims to have identified ceramic-production areas in the Upper Basin, and it is possible that some thermal features in the river corridor served a similar function. The identification of specific, localized production areas within the river corridor as a whole, and within sites corresponding to specific time periods, would be a crucial first step toward examining evidence for increasing craft specialization over time.

II. E. Exchange

It has been argued that exchange systems serve as buffering mechanisms in situations where resources are patchy or unpredictable (Upham 1982). In agricultural societies, the production of food surpluses during favorable years can be "banked" by converting these surpluses into highly valued commodities such as shell, turquoise, obsidian, and other nonperishable items, which can later be exchanged for subsistence commodities when local agricultural yields are insufficient (Upham 1982:119). Others suggest that exchange systems serve mainly to cement social alliances, which may also function as important buffering mechanisms in unpredictable environments.

Historically, the Pai inhabitants of the Grand Canyon served as middlemen in a long-distance exchange network connecting the Pueblos of the American Southwest with the Gulf of California and the Pacific Coast. The Havasupai traded locally produced materials, such as buckskins, agave, and hematite, to the Hopi in exchange for cotton blankets, painted pots, and agricultural products. In addition, they traded shells and turquoise obtained through down-the-line exchange with their Hualapai neighbors to the west, who were, in turn, in frequent contact with the Chemehuevi and Mohave people to the west and south, respectively. Colton (1941) believed that these exchange networks, and specifically the trade relationship between the Hopi and the Havasupai, had existed in an essentially identical form for many centuries.

Prior to the 1100s, the Virgin Anasazi in the Lost City region (the confluence of the Colorado and Virgin Rivers) apparently filled this middleman niche (Lyneis 1982, 1984), filtering shells and turquoise to the Pueblos in the east, perhaps also along with cotton and salt. Rafferty (1990) argues that the Virgin Anasazi developed into a chiefdom-level society by controlling the trade of goods between the Pacific Coast–Mohave Desert regions and the Colorado Plateau, a scenario that most archaeologists find unsupportable (e.g., Lyneis 1996:23). Nevertheless, Lost City seems to have been an important focal point for the exchange of goods between the Colorado Plateau and points farther west.

Although historically the exchange system seems to have followed a predominantly east-west alignment, there is clearly evidence for prehistoric cross-canyon exchange as well. For example, Lesko (1989) documented several examples of obsidian from the San Francisco and Mount Floyd volcanic fields occurring on sites on the Kaibab Plateau. Historically, there is considerable ethnographic evidence for the Pai and the Paiute crossing the river sometimes to raid and at other times to trade. During the later 1800s, Navajo traders regularly crossed the river to trade horses and blankets to the Mormon settlers, primarily in exchange for guns.

The archaeological study of exchange systems is important not only from the point of view of trying to explain cultural processes of risk mitigation and social evolution, but, more basically, as a means of identifying the changing networks of interregional relationships through time.

Wesley Bernardini (2002) recently completed an elegant study of Hopi Yellow Ware ceramics, demonstrating connections between late-prehistoric migration patterns, ceramic production and exchange, and the maintenance of social networks. Similar studies on Late Formative ceramics in the Grand Canyon region could shed light on the early history of patterned village movements that ultimately resulted in the configuration of clans and villages found at Hopi today.

II. E. Questions

1. Based on chemical sourcing of exotic trade items from the river corridor, such as obsidian and turquoise, how do regional connections seem to vary over time, if at all?
2. Can we detect a trend toward an expansion in trade networks during the Formative period?
3. How widely were locally produced ceramics (e.g., Jones 1986; Sullivan 1995a:60) exchanged, and in what directions?
4. How do distributions of trade goods compare spatially with the known locations of prehistoric trails in the Grand Canyon, and can we use these distributions to identify trade routes that served as interregional trade routes in prehistory?
5. What is the evidence for the prehistoric or historical-period exchange of plants such as agave between the Grand Canyon and other regions of the Southwest?

Data Needs:

- Distributional data on exotic items and sourced materials such as obsidian, shells, and turquoise; distributional data on locally produced ceramics
- Regional GIS data showing the distribution of these items in relation to known routes and trails
- GIS data on the distribution of rare or economically or ceremonially important plant species
- Genetic analyses of rare plants, such as *Agave phillipsiana* (Hodgson 2001)

Approaches and Methodological Considerations

The study of exotic trade goods from sites in the river corridor has the potential to greatly expand our understanding of how the Grand Canyon, and specifically the river corridor, may have functioned at various times as a boundary zone, filtering goods from one side of the river to another, or as a corridor, linking exchange systems to the east and west. Species-specific identification of traded shell items; sourcing of obsidian and turquoise using minimally destructive techniques, such as laser ablation; and tracking prehistoric and historical-period distributions of local minerals, such as malachite and hematite, and locally produced items, such as travertine pendants and ceramics (Jones 1986), could be used to reconstruct exchange systems. Future analysis needs to examine not only presence/absence data, however, but also the frequencies of traded items, in order to get at the possible types of exchange systems operating in the past (e.g., down-the-line exchange versus redistribution networks from centralized locations.) These types of analyses could be profitably pursued with existing museum collections, as well as with materials that may be eventually recovered from future investigations in the river corridor. GIS is a potentially useful tool for analyzing distributions of traded items over time and across space.

III. Landscapes

The preceding sections have laid out a strategy for refining our current understanding of how the environment of the river corridor has changed over the past several thousands of years as a result of both human and nonhuman agents and provided a method for distinguishing the various cultural entities and influences that have operated in the Grand Canyon through time. The questions presented in the preceding sections have not been bounded by any particular theoretical perspective, but are primarily designed to create a more complete and accurate picture of who was present, when events occurred, where they occurred, and what took place in the river corridor during the past 5,000 years. This next section is concerned with exploring how the land and people have interacted over time to produce not only the multilayered landscape of the inner canyon, but also the ethnically diverse landscape of the modern-day Colorado Plateau.

Compelling historical, ethnographic, and archaeological evidence suggests that the river corridor has functioned at various times as an "edge," in the ecological sense of the term, and other times, as a "corridor" or "habitat." In cultural terms, it seems to have served as a boundary and a cross-cultural interaction zone for certain cultures at specific times (e.g., protohistoric period), whereas at other times (e.g., Pueblo II), certain sections of the river corridor, such as Reach 5, appear to have functioned as the center of a localized, horticulturally oriented economy, and then later as the "spiritual heartland" of more distant communities (e.g., historical-period Hopi and Zuni). For other cultures and time periods, such as the Late Archaic and Preformative, there is insufficient information to determine what role the river corridor played.

To take the ecological analogy further, ecologists often categorize species in terms of their dependence on particular habitats. Thus, there are endemic or obligate species that must live in that habitat in order to survive, there are generalist species that use a variety of habitats and are not dependent on any particular one, and there are facultative species that use one or more habitats preferentially. Cultures, in some respects, also fit in these categories. Although humans have a remarkable capacity for change and adaptation, certain cultural adaptations are dependent on specific environmental attributes. For example, if early corn agriculturists relied on maize species that required long growing seasons and plenty of water, they would have been obligated to settle areas in which those necessary environmental attributes existed. Likewise, a growing dependence on cotton among the Late Formative Pueblos may have required access to the river corridor, with its consistently warm temperatures and irrigation possibilities, at least until the cotton plants could be genetically manipulated to withstand the rigors of life on the upland plateaus. Transhumant hunter-gatherers, on the other hand, made use of multiple environments but were not overly dependent on a single habitat; in that sense, they fit the definition of generalists. The protohistoric Pai and Southern Paiute probably fell somewhere along the continuum between generalist and obligate cultures—they made holistic use of diverse environments but focused their mobility patterns and situated their base camps and gardens near springs (and ultimately their sense of identity became tied those springs) (Dobyns and Euler 1999; Hualapai Tribe 1993; Kelly 1964; Kroeber 1935).

Each successive cultural group that has interacted with the Grand Canyon has been influenced by the experience. The nature of past interactions with the Grand Canyon determines, to some as yet unknown extent, the people's current relationship with this place and its landscape(s). One might argue that cultures that once depended on specific ecoscapes, such as the river corridor, might feel a particularly deep attachment to that place, but this is undoubtedly an oversimplification of what is, by all accounts, a complex and currently evolving research issue: how and why people develop a "sense of place" (Anderson and Gale 1992; David and Wilson 2002; Feld and Basso 1996; Gupta and Ferguson 1997; Tilley 1994; Tuan 1977).

Euroamericans are used to thinking in terms of how people modify land into landscape. This reflects our cultural biases toward thinking about humans as agents of domination, change, and progress. But people not only change the land, the land changes people. Over decades and centuries of interaction, the land and the surrounding environment shape people's ideas about who they are and how they fit within the world. This influence of land upon people is reflected, in turn, in how people relate to and interact with the land over time, including how they relate to the traces of those who preceded them.

When different people with different cultural templates inhabit the same space, either contemporaneously or sequentially, the mutually reinforcing agents of environmental processes and human values result in a palimpsest of multiple, overlapping landscapes. One goal of landscape archaeology is to sort out the layers and reconnect the pieces to produce a more holistic picture of past lifeways at given points in time. For Native American people, however, these landscapes are not mere records of ecological or historical change. They are place-based, tangible testaments to their own cultural traditions. They are sources of continuing spiritual and cultural renewal. The ancestors' footprints in the land obligate Native American people to protect and care for it. Their sense of identity is tied to the land. This is what Havasupai chairman Lee Marshall tried to convey when he spoke at a public hearing concerning the proposed expansion of Grand Canyon National Park and stated so memorably: "I heard all you people talking about the Grand Canyon. Well you're looking at it. I *am* the Grand Canyon" (Hirst 1985:204).

III. A. Ideology

As was discussed at the outset of this chapter, all cultures apply meaning to the world in which they live. This meaning is expressed through our behavior in relation to the world. This behavior leaves its traces—its landmarks—across the land (Zedeño et al. 1997), often in recognizable patterns, but at other times, in very specific and unusual ways. In so doing, humans transform land into landscape. For example, consider the widely researched topic of mining in the Grand Canyon (Billingsley 1976; Billingsley et al. 1997). Most miners throughout time have left a tangible record of their activities in the Grand Canyon. Nineteenth-century miners left an archaeological record in the form of numerous abandoned campsites, rock cabins, mine shafts, talus tailings, and discarded tools. They reconstructed and rerouted ancient footpaths to accommodate pack stock. At the mines, they typically left shallow adits or deep shafts, discarded ore samples, and abandoned equipment and the debris of everyday life. At the Hematite Mine downstream of Lava Falls, there are Pueblo II–Virgin Anasazi potsherds, some Pai and Paiute pottery, grinding and pulverizing tools, and abundant charcoal. At the Hopi Salt Mine, there are petroglyphs, salt-encrusted clay figurines, and prayer feathers. How does the archaeological record associated with these various mining sites inform us not only about the technological and artistic capacities of the previous cultures that used them but also about their ideology?

Or consider how different cultures have interacted with springs in the Grand Canyon. The Hualapai have a tradition of being taught to live at a distance from springs to avoid the adverse consequences of coming into contact with their spiritual inhabitants (Ewing 1961). According to Ewing, this traditional admonition was reflected in the

Haulapai practice of camping at least a half mile from spring sources. Euler and Dobyns remarked that their "extensive archaeological surveys in Pai territory" attested to the veracity of this observation (Ewing 1961:23, footnote 9). Yet, agave-roasting sites are sometimes found much closer to water sources, for example, at Cedar Springs on the Tonto Plateau. This site has been presumed to be ancestral Pai, but perhaps a closer examination of the evidence is warranted. On the Coconino Plateau, rock art attributed to the Cohonina commonly occurs at springs and the more permanent water holes. The Virgin Anasazi seem to have marked many of the water sources on the Arizona Strip in a similar manner. Do similar patterns occur within or near the river corridor? What might they reveal about the people's perception of and relationship with springs and other landmarks?

III. A. Question

Considering both Native American and Euroamerican perspectives, and using historical, ethnographic, and archaeological data sources, how did different cultures conceptualize their roles within the landscape, as expressed through the placement of landmarks on the landscape?

Approaches and Methodological Considerations

GIS is one possible tool for analyzing the distributions of specific kinds of landmarks in time and across space. Applying a variation of the traditional approach to archaeological-settlement analysis would be one way to begin to understand people's past relationships with and conceptions of place. A combination of empirically derived observations, ethnographic data, and historical data can be used to define the likely salient physical and ecological attributes that determined landmark placement cross-culturally. The placement of temporally specific, similar types of landmarks could then be analyzed using GIS in hopes of recognizing spatially significant patterning of landmarks during various times in the past. The spatial patterning would presumably reflect cultural perceptions about appropriate landmark placement.

Many forms of ideological expression are embedded in the landscape of the Grand Canyon. Some—perhaps many—of the traditional Native American landmarks may not be obvious to Euroamericans. Some may be marked by inconspicuous rock features; others are simply expressed as configurations of landscape elements that signal the existence of a place of power (Stoffle and Zedeño 2001a:70–71). Consultations with the tribes are necessary to identify features or areas that may have esoteric meanings attached to them.

Beyond simply identifying places of traditional cultural importance, however, additional interviews with traditional Native American scholars are needed to understand the meanings and values that modern tribes ascribe to the landscape. Most of the interviews conducted with tribal elders for the GCES-II program tended to be open ended and participant directed. A more focused approach that is specifically concerned with elucidating the bonds between people and landscape features and articulating the significance of these features from a traditional cultural perspective would help future land managers appreciate the complexity of these relationships in the present and, at the same time, help to elucidate the possible nature of such relationships in the past. Rather than asking how or why the Grand Canyon and its sites are significant to the tribes, however, perhaps a more productive line of inquiry would be to ask participants to consider how historical and modern identities are tied to the land—and the river corridor specifically. A related additional issue could be explored: how people express these ties in their current roles and activities with respect to the landscape and also through their own culturally prescribed understanding about what makes places attractive for plant gathering, living purposes, ceremonial events, and other activities. Through consultations with the tribes, reference to the existing ethnographic literature, and rigorous landscape analysis, we may be able to shed some additional light on how people conceptualized their relationship with the land in the past and also how this relationship is conceptualized in the present.

Using GIS, it would be possible to analyze this information spatially to produce a series of "cognitive maps" of the Colorado River corridor, representing a variety of cultural perspectives about what constitutes important landmarks and attributes of the landscape. (These maps need not be restricted to Native American templates, but could also include those of other affiliated communities, such as river runners and trout fishermen.) With time and the accumulation of additional data, they could also be reconstructed for the various prehistoric and historical periods. These "cultural-landscape portraits" would depict the locations of various cognitive domains, such as residential areas, resource-procurement zones, and ritual and communication loci. By overlaying these maps in a GIS, we may be able to identify areas of greater or lesser sensitivity for all concerned groups combined. GIS also permits simple correlation analyses to be performed between known site locations and key environmental variables.

This approach might allow for the identification of additional areas with a high potential for containing additional cultural resources that have not yet been recognized on the basis of surface attributes.

III. B. Cultural Transformations

One of the principal ways humans adapt to environmental circumstances is by altering and redefining the landscapes in which they live. But those changes may, in turn, bring about unforeseen environmental consequences, which must then be responded to. Cultures therefore do not merely react to environmental change, they are also agents of change. Cultures are part of an organic process in which natural and cultural forces intersect and influence each other through time.

The rate at which cultures adjust to changing environmental circumstances can vary considerably, depending, in large part, on the historical circumstances that produced the original adaptation. Cultural templates, or traditions, evolve in response to specific adaptational needs and requirements. When conditions remain stable and predictable over extended periods of time, successful traditions may become deeply entrenched and rooted in the landscape. Yet the very success of these cultural systems, as reflected in their deeply rooted traditions, can threaten a culture's survival when it limits the culture's ability to adapt efficiently to changing circumstances. Entrenched cultures may adopt a series of temporary social, religious, or technological "fixes" to address changing circumstances as they attempt to maintain the prevailing cultural system; but if these mechanisms prove unsustainable, migration to alternative habitats (to allow for the perpetuation of the existing cultural system) is one likely response, rather than an in situ radical transformation of cultural norms. In contrast, some cultures develop in the context of highly variable and unpredictable resource distributions, and these cultures may be much more capable of adjusting to changes in their social and/or physical environment, allowing them to outcompete their neighbors during times of stress. This cultural "flexibility" may also find expression through interactions with the physical environment that result in very different kinds of landscapes. The Grand Canyon provides a wonderful laboratory for exploring these fundamental issues about the capacity of human cultures to transform themselves as they interact with and adjust to changes in their physical, technological, social, and political environments.

For example, consider the issue of Preformative agriculturists in the Grand Canyon. Matson (1991) has proposed a model to explain the distribution of technological and other cultural characteristics on the southern Colorado Plateau during the period from 1500 B.C. to A.D. 500 that relies on a modified version of the migration hypothesis proposed by Berry and Berry (1986). Matson argues that Basketmaker II archaeology on the southwestern portion of the Colorado Plateau reflects an immigration of corn-dependent populations from southern Arizona, whereas on the southeastern Colorado Plateau, Basketmaker II remains reflect the transformation of an indigenous Archaic economy to one increasingly dependent on farming. He relies on distributions of diagnostic-attribute classes, such as two-rod-and-bundle bunched coiled basketry and San Pedro points, to argue his thesis. The as-yet-unstudied record from the Basketmaker II period in the Grand Canyon is a critical missing piece of this story, one that could "make or break" the Matson migration model. To test the validity of Matson's model in the Grand Canyon, we could formulate several "testable" hypotheses. For example, we could predict the types of technology (San Pedro points, two-rod-and-bundle basketry) that should be present in association with the dated hearths if they are, in fact, the product of western Basketmaker II horticulturists. We could also make predictions about the technological assemblage likely to be encountered if they are not the product of Basketmaker II people (e.g., Huber and Bradley 1998, 1999). We could also posit some more formal hypotheses, such as "If Matson's model is correct, assemblages associated with hearths containing charred corn should be similar to those identified for the White Dog phase elsewhere in northern Arizona." Of course, there is also the possibility that artifact assemblages will be found in association with the hearths, but corn will not, raising other interesting questions about the nature of adaptations and interactions in this part of the Colorado Plateau during this crucial time period.

But there is an entirely different dimension to the Basketmaker II story, one rarely discussed in archaeological studies of this period. It can be framed by the following question: To what extent was the Puebloan transformation from a family-based, semisedentary horticultural society with a shamanistic ritual focus to a clan-based, sedentary village society with community-based rituals the result of interacting with the local environment and being modified by those landscape interactions, rather than being a product of the factors so commonly cited, such as climate change or population pressure? If Matson (1991) is right, and the origins of western Basketmaker II culture are rooted in a migration of floodwater-farming San Pedro farmers to the Colorado Plateau ca. 1000 B.C., the desert riverine environment of the inner Grand Canyon would have offered a natural draw for them, giving them a familiar feeling of "home" in the midst of the unfamiliar Colorado Plateau. How did early farmers go about transforming that natural landscape into a home? And how did the development of that home transform them in turn?

The transformation of prehistoric cultures, as reflected in the archaeological record, can also be evaluated in the context of technological innovation, regional social dynamics, and the evolution of religious and ritual systems (Rappaport 1984). For example, Fairley (1997a) proposed that the appearance of distinct regional expressions of ancestral Puebloan traditions in northern Arizona around A.D. 1000 could be at least partly attributed to the introduction of cotton farming on the Plateau at this time. The appearance of kivas in the western Anasazi archaeological record after A.D. 1000 (with floor features such as loom anchors and sand-filled basins where sipapus are later found) may reflect the transformational effects of the cotton farming in progress at that same time. She also suggests that the Pueblo II population expansion and the development of irrigation horticulture on the Colorado Plateau may be, at least in part, an expression of this eleventh-century agricultural innovation, especially as reflected in the intensive use of canyon lowlands at this time (e.g., Ambler et al. 1983; Geib 1996). If the recent claims by Davis et al. (2000), suggesting that cotton was being grown in the Grand Canyon as early as A.D. 600, are substantiated by future archaeological research, this raises other interesting possibilities as to how the theme of cotton (with all of its esoteric symbolism as rain, clouds, and breath) has come to have such an important symbolic role in traditional Hopi mortuary rituals.

Zedeño (1997) offers yet another way of thinking about cultural transformation. Her seminal article on Puebloan territory formation focuses attention on both the processes and products of territorial definition, as reflected in the ethnographic records of the Hopi Lands Claims case. Her work highlights the changing nature of the relationship between the Hopi people and their traditional use area over time, emphasizing how these changing relationships are reflected not only in terms of the material record of the landscape but also in terms of how specific landmarks are perceived and used over time. These ideas are particularly germane to the Grand Canyon, where numerous cultural groups have made territorial claims to the same piece of ground and the river that flows through it.

III. B. Questions

1. How did prehistoric and historical-period relationships with the Grand Canyon influence or transform indigenous cultures, and how are these changes reflected in modern-day Native American cultures of the Colorado Plateau?
2. How are modern tribal identities tied to the landscape of the Grand Canyon, and how are these ties expressed through landscape today?

Data Needs:

- Identification of site-specific functions, employing both emic and etic perspectives
- Site-specific distributional data; ethnographic data on landmark types and placement
- Information on Hopi, Hualapai, Navajo, Southern Paiute, and Zuni place-names and other linguistic data that may be relevant to understanding modern Native American conceptions of the Grand Canyon landscape

Approaches and Methodological Considerations

Zedeño's (1997) approach to studying territory formation in terms of a series of stages—exploration, colonization, settlement, use, change/abandonment, and reclamation—offers one useful model for structuring future inquiries concerning the evolution of landscapes in the Grand Canyon and people's changing way of conceptualizing their relationship to the Grand Canyon over time. Although her identification of specific landmark types and their material correlates are not necessarily applicable to all of the cultures who have laid claim to the Grand Canyon, the basic premise of her model is pertinent: people's relationships to landscapes change over time in more-or-less predictable and patterned ways, and these changing relationships are reflected in the types of landmarks they leave at various points in time. By referencing other land-claims cases and existing ethnographic literature and conducting focused interviews with native cultural scholars, we may be able to identify a similar series of landmark correlates that reflect the changing nature of landscape relationships experienced by the various cultural groups who are affiliated with this landscape today.

The study of place-names is another potentially fruitful avenue for furthering our understanding of people's current and historical relationships with the Grand Canyon and the Colorado River. The individuals and events commemorated by these names reflect not only people's history but also their sense of cultural identity. Although beyond the immediate scope of this research design, linguistic studies in general can offer a valuable avenue for furthering our understanding of how people conceptualize themselves in relation to places (Michael Yeatts, personal communication 2003). More directly pertinent to this research design, however, are the stories, songs, and rituals that incorporate elements of the Grand Canyon and the Colorado River. The ritual uses of rocks, minerals, plants, and water derived from the Colorado River or the inner Grand Canyon and the telling of stories centered in and around the Grand Canyon are testaments to people's enduring connections to this place.

Interactions between land and people transform cultures in ways we are only beginning to understand. Although the processes by which cultures are transformed remain poorly understood, we see the end result in modern-day cultures, as, for example, the Hopi, for whom "the entire Hopi ritual structure is dependent on emplacement within the particular landscape" (Whiteley 1988:57). To begin to get at these processes, we need to examine a full spectrum of archaeological evidence over time and across space. We need to look at the distribution of specific artifacts in time and space, especially those with high symbolic content, such as rock art. We need to consider the configuration and placement of communities in a given landscape context and how they change over time. We need to examine trail linkages with other cultural landmarks during each time period. We need to bring both Euroamerican and Native American perspectives to these research efforts, recognizing that neither the emic or etic view alone can fully account for the reasons behind people's choices. We probably will not be able to resolve the issue of how and why cultures are transformed over time and across space by looking just at the river corridor, but perhaps the results of our research efforts here can start us on the path to understanding how people transform land into culturally valued landscapes, and how these landscapes, in turn, become enmeshed with cultural identities.

CHAPTER 7

Landmarks, Property Types, and Research Priorities

Archaeologists and other cultural scholars working in the Grand Canyon today confront a major challenge as they attempt to devise a suitable means of teasing apart the multiple layers of history embedded in the landscape. Not only do we need to be able to recognize the diversity of cultural traditions represented by the physical traces that have been left behind, we also need to be able to view them from a multicultural perspective to fully appreciate and interpret the landscapes' scope and richness. It is imperative, therefore, that property types be defined in a manner that allows for the representation of multiple values and interpretations, not just a single theoretical paradigm.

This research design is organized within a broad, landscape-focused historic context: the interactions of land, people, and landscape within the Grand Canyon river corridor, 8000 B.C.–A.D. 2000. The development of this historic context involved assessing the types of cultural resources that were known to exist in the river corridor between Glen Canyon Dam and Lake Mead, compiling and synthesizing the existing information on these resources (emphasizing an archaeological perspective, but acknowledging and including the diverse perspectives of the various Native American cultures with long-standing traditions embedded in the landscape), and then articulating a series of research questions specific to the river corridor and its varied landscapes over time. The final step involves linking the research questions to the range of cultural resources found in the river corridor through the concept of property type.

Property types are essentially similar classes of historic items, usually buildings, structures, sites, or objects. NPS (1991:14) guidelines suggest that these classes should share physical attributes as well as associations with historical themes. In the Grand Canyon, it is a real challenge to define property types in a manner that has broad applicability to the diverse cultural traditions that made use of the canyon in the past and still keep the numbers of distinct property types within a manageable range.

When the archaeological inventory of the Grand Canyon river corridor was carried out in 1990–1991, it was done without an explicit research design driving the data-collection process. The principal purpose of the inventory was to locate evidence of human activities in the river corridor in the past and document their locations in space and time—along with their visible attributes, their condition, and a cursory assessment of the extent to which the operations of Glen Canyon Dam may have affected these cultural resources. The orientation was strictly archaeological. No attempt was made to understand or interpret the remains from a cross-cultural perspective. Furthermore, although archaeological research values were considered in passing, no attempt was made to place the findings in a theoretical context or to use the inventory results to address specific research concerns.

In summarizing the inventory results, individual sites were grouped into 25 "site type" categories based on visible surface attributes (Fairley et al. 1994:12–13). The original categories included: (1) pueblo, (2) small structure, (3) temporary structure, (4) storage site, (5) enigmatic feature, (6) sherd scatter, (7) lithic scatter, (8) artifact scatter (combination of 6 and 7), (9) isolated thermal feature, (10) roaster complex, (11) camp (artifact scatter with thermal feature), (12) isolated pot/cache, (13) burial, (14) ground stone cache, (15) other tool cache, (16) water/soil control feature, (17) bedrock mortar, (18) trail, (19) rock art, (20) inscription, (21) historical-period trash scatter, (22) historical-period structure, (23) other,

(24) delta complex (multiple structures and/or agricultural features concentrated on an alluvial fan), and (25) unknown. As is not uncommon with archaeological site types, the original typology included a mix of functional types and purely descriptive ones. This fact, in addition to the relatively large number of types and the difficulties encountered by subsequent researchers in maintaining consistency in type definition, led the Grand Canyon river-corridor project archaeologists to revisit the issue of site types in 1998.

Subsequently, Grand Canyon archaeologists attempted to streamline site types by collapsing the original 25 types into 10 categories (Leap et al. 2000:3–6). This scheme also proved unsatisfactory, however, because the property types mixed functional and descriptive attributes, and the categories lumped sites representing multiple unrelated modes of behavior under a single label. Furthermore, some types were specific to a particular time period (e.g., historic-structure pueblo), whereas others crosscut multiple time periods (e.g., roasting feature, rock art). The PA signatories therefore requested that the concept of properties types be reconsidered.

The landscape approach offers an alternative means of conceptualizing and categorizing property types in the river corridor. As noted repeatedly, this research design focuses on how land and people interact to create landscapes—specifically, how people transform land into landscape and how landscape in turn transforms people. Zedeño (1997; Zedeño et al. 1997) provides a useful framework for thinking about how these interactive processes unfold over time. As people live in a place and form attachments to it, they express this relationship through the creation of landmarks. According to Zedeño et al. (1997:125), landmarks are locational markers designating places where interactions and activities between land and people occurred. These landmarks may be unmodified natural features that acquired special meaning over time because of events associated with them, or they may be special places that certain cultures consider inherently valuable by virtue of having culturally important attributes. Alternatively, landmarks may be individual constructed features or constellations of other material remains created by past human activity (Figure 58).

Grand Canyon Landmarks

Zedeño (1997:77–78) conceptualized landmarks as being related to one or more of four basic categories of human activity: living, resource procurement, food production, and ritual. Whittlesey (1998:24) added a fifth category of behavior to the list: communication.

The various cultures that left their imprints in the Grand Canyon river corridor engaged in one or more of these activities during their tenure there. Their specific cultural templates (values, traditions) resulted in the creation of diverse landmarks and landscapes. Each cultural group organized its activities on the landscape in different ways, some of which had parallels with earlier or later groups, whereas others were unique to a particular cultural system. Very briefly, let us review what we know about the history of Grand Canyon landscape formation and human use from the perspective of the land-use categories defined by Zedeño (1997) and Whittlesey (1998).

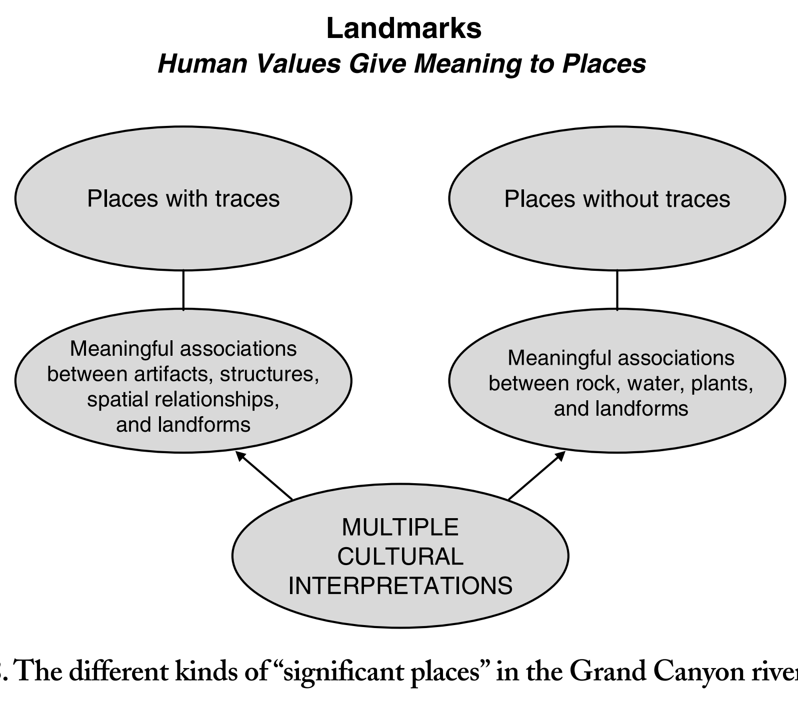

Figure 58. The different kinds of "significant places" in the Grand Canyon river corridor.

Paleoindian and Early–Middle Archaic Periods

Essentially, we know nothing about these time periods in Grand Canyon prehistory, either in terms of specific landmarks or the landscape in general. We have information from pack-rat middens indicating that climate and vegetation in the past differed significantly from modern conditions. Virtually any additional information concerning environmental conditions and human activities during these early time periods would be an asset to our current understanding of river-corridor prehistory and the prehistory of the Grand Canyon region as a whole.

Late Archaic Period

Most of what we know about this period in the Grand Canyon region comes from the study of split-twig-figurine sites. In other words, we have considerable information about Late Archaic ritual landmarks represented by a single artifact class, but we know essentially nothing about other components of the surrounding Archaic landscape. In fact, until recently, it seemed as though the inner Grand Canyon may have been used only for ritual purposes during the Late Archaic. Although further study may substantiate this, an increasing number of clues suggest that Late Archaic hunter-gatherers used the canyon for other purposes as well, including resource procurement, communication, and residence. We have evidence of Archaic habitation sites from several parts of the canyon, mostly in sheltered settings. Future research efforts need to be focused on gathering information related to all aspects of the Late Archaic landscape in the Grand Canyon, beyond the ritual use of caves.

Preformative Period

Along with the Paleoindian and Early–Middle Archaic periods, this is the time period we know the least about in all respects. Currently, the sum total of our knowledge about this crucial transitional period consists of a few radiocarbon dates from hearths in the Tanner area (Fairley 1992; Fairley and Hereford 2001, 2002), from a buried roaster near Whitmore (Jones 1986), and from a stratigraphic context in the Arroyo Grande area (Hereford et al. 2000a). In addition, data collected by Davis et al. (2000) indicate that corn may have been grown in the eastern Grand Canyon during this period. The geomorphic context in which these dates were found suggests that the river corridor was undergoing a period of alluviation at this time, but this needs to be verified by conducting additional geomorphical studies that are specifically focused on reconstructing the paleolandscape of the river corridor. Aside from the possibility of corn cultivation (and this still needs to be verified using lines of evidence other than just pollen), we know essentially nothing about the kinds of associated activities that produced these dates, much less how these activities produced configurations of landmarks specific to this period. Once again, virtually any additional information about the human and environmental components of the Preformative landscape would put us much further ahead of where we are today.

Early Formative Period

This is another time period in Grand Canyon prehistory that warrants further attention from archaeologists and geomorphologists in every respect. This is the time when ceramics first appear in the archaeological record. During the latter part of this period, we are able to detect cultural diversification on an intraregional level, as reflected in the ceramics and other tangible traces on the land. Our current understanding of this period in Grand Canyon prehistory, however, is largely based on inferences derived from the archaeological record of surrounding regions. Depending on the particular biases of previous researchers and where they were working, archaeological remains dating to this period have been variously classified as Cohonina or Anasazi (Virgin or Kayenta Branch). We need to reexamine these traditional archaeological categories (cf. Fairley 1979) in light of information derived specifically from the Grand Canyon, and especially from the river corridor, where these regional expressions co-occur.

As with the preceding period, we have only a very sketchy and incomplete picture of the Early Formative environment. Current knowledge is based primarily on the geoarchaeological research conducted by Hereford and others and, to a lesser extent, on dendrochronological reconstructions from surrounding areas. These data sources suggest that during the first part of the period, up to A.D. 700, or perhaps A.D. 800, either alluvium was not deposited, or it was removed by one or more major flood events. From A.D. 800 on, specific reaches within the river corridor accumulated more sediment than was removed. Why this occurred, what it might mean in terms of the local and regional climate, and how this would have affected vegetation in the river corridor remains to be determined through future study.

As for landmarks of this period, we know that people were living in the river corridor, at least during the latter part of this period, as well as on both rims and the surrounding plateaus. Within the corridor, living spaces have been identified in both open settings and in rockshelters. At least one pit-house site and a site with multiple slab-lined cists have been ceramically dated to the latter part of this period. We have evidence from ceramics that people, ideas, or both were coming into the river corridor from the east, as well as from both the North and South Rims in the western part of the canyon. We also know that people were procuring resources from the inner canyon, although we know very little about how or where or what these resources might have been. Direct evidence for food production within the river corridor is currently limited to some very tentative evidence for cotton and corn agriculture in the Nankoweap area (Davis et al. 2000). How food procurement and production within the inner canyon may have been linked with similar activities in surrounding upland areas remains to be determined. We know essentially nothing about ritual uses of space, and our grasp of the communication networks during this time period is limited to inferences about trails that may have been used to connect sites in the river corridor with those of surrounding areas. Once again, we are just barely leaving the starting gate in terms of our knowledge about this time period in the Grand Canyon.

Late Formative Period

Relative to the preceding periods, we know considerably more about this landscape in Grand Canyon prehistory. Most archaeological studies have tended to emphasize the interpretation of Late Formative Puebloan remains, especially architectural and ceramic components. However, we still have only a vague understanding of how the pieces might fit together into a landscape framework.

We have documented (in a fairly cursory manner) dozens of Late Formative habitation structures as well as numerous storage and agricultural features. We have identified habitation sites in both open and sheltered settings. These sites usually involve the partitioning of living space into one or more "rooms." However, we are still basically guessing about the more specific aspects of these habitation spaces, such as the season(s) in which they were used and for how long, how they were organized in a functional sense, how they were organized at the community level, or which specific construction techniques were used in demarcating living areas. These are important topics for research, as they bear directly upon our ability to accurately interpret many other aspects of the Late Formative landscape.

We know that Late Formative people procured a broad spectrum of resources within the canyon. We find traces of activity at mineral deposits, along game trails, and in a wide variety of ecological settings. Caching behavior appears to have been an important component of Late Formative adaptations, and we find constructed granaries and pottery caches along many routes leading out of the canyon. We could benefit, however, from more rigorous analyses of the botanical, lithic/mineral, and faunal remains found at these sites, as well as in the habitation sites of this period—with an eye toward more specifically locating and documenting the places that resources came from, thereby enhancing our holistic understanding of how Late Formative people made use of landscape on a regional level.

As for food-production spaces, we know that they existed. Beyond that, however, we have little empirical evidence with which to describe or evaluate them. A few areas behind checkdams were tested for pollen by Schwartz et al. (1980), but aside from this early work and the most recent soils work by Davis et al. (2000), we have made little progress in identifying specific food-production locales within the river corridor. Davis's recent soils research near Comanche Creek suggests one possible avenue for further research—using soil chemistry in conjunction with pollen to distinguish anthropogenically altered soils in the river corridor. Traditional Native American farmers could help to identify potential field areas, which could then be tested for chemical and pollen data.

Ritual spaces in the Late Formative landscape have been recognized in a few instances. Aside from the rare kiva, which is generally associated with habitation sites, the only other Late Formative landscape-feature type that has been considered to have a ceremonial function consists of the few anomalous hilltop sites. More subtle indications of ritual use of specific places have not been identified, although they undoubtedly exist. This is a research area for which the participation of traditional Native American scholars is essential.

Communication landmarks from the Late Formative—in the form of routes, developed trails, and rock-art sites—are fairly common. However, no formal studies have been done of any of the rock-art sites within the river corridor, nor has there been any analysis of their patterned occurrence in the landscape.

Late Prehistoric/Protohistoric/ Early Historical Period

This time period encompasses the approximately 600 years between the time ancestral Puebloans ceased to inhabit the inner canyon and before Euroamericans made permanent inroads in the area. Most current interpretations of this time period are based on ethnographic accounts and oral traditions, rather than on empirical observations of the archaeological record.

Habitation sites dating to this time period are common. They are most frequently identified in rockshelter settings, although open-area residential camps are also known. These sites are often—although not always—associated with one or more roasting features and are generally assumed to have been occupied repeatedly on a seasonal basis. Food-procurement and -processing locales are also fairly common. These consist of isolated roasting pits, bedrock mortars, and clusters of grinding implements. Havasupai informants told William Bass that many of the granaries in Havasu Canyon and along the canyon rims were theirs (James 1900:203), so, presumably, at least some of the constructed storage features in the river corridor also date to this time period. Independent verification of this association could potentially be accomplished by performing a dendrochronological analysis of wooden construction elements.

Food-production sites from this period have not been identified in the river corridor, despite the fact that we know of at least one historical-period garden from the Powell expedition's account, and ethnohistorical records indicate that both the Pai and the Paiute engaged in farming. It may be that farming within the canyon was strictly a historical-period activity, although this seems unlikely. In addition to farming, Paiutes historically constructed deadfall traps along the bases of cliffs and in overhangs to trap rodents for food. A few of these features were found during the river-corridor inventory, but presumably many more went unrecognized. Ethnographic information also indicates that Paiutes managed vegetation through burning (Thom Alcoze, personal communication 2002).

Most of the hematite and white-clay pictographs in the western Grand Canyon are assumed to date to this time period or slightly later. Euler, however, believed that the Cohonina were responsible for many of the hematite pictographs in other parts of the canyon. A stylistic analysis of pictographs, perhaps in conjunction with experimental dating techniques, could help to distinguish the rock art specific to this time period.

Ethnographic information suggests that both trails and rock art frequently demarcated Paiute ritual locations (Stoffle et al. 1997, 2000; Stoffle and Zedeño 2001a). Although we cannot know with certainty whether these values were shared by the prehistoric people of the area, it is likely that they were. In addition, certain natural landmarks, such as Vulcan's Anvil, are considered to be places of power by both the Pai and the Paiute people. The involvement of Native American cultural scholars is essential for building a framework for understanding how ritual places can be recognized in the late prehistoric, protohistoric, and early historical landscape of the Grand Canyon.

Late Historical Period

The late historical period spans the century between A.D. 1850 and 1950, when Euroamericans first penetrated the interior portions of the Grand Canyon. Euroamerican culture first arrived in the form of explorers and trappers, then as prospectors, and finally as tourists, recreational users, and federal land managers. It was also a time when Pai, Paiute, and Navajo people sought refuge in the canyon interior from military and social oppression. During this time, the Hopi and the Zuni continued to engage in long-distance trading ventures with the Havaupai and the Pai and to pay homage to their ancestral lands and ancestral spirits. All of these diverse cultural activities produced (or in some cases maintained) landmarks within the river corridor.

Habitation sites of this period are highly variable, ranging from small ephemeral camps to masonry cabins. Rockshelters were used by all cultural groups. Sites of this time period are generally recognized on the basis of Euroamerican artifacts or architecture, so indigenous sites lacking these artifacts are likely to have been inadvertently assigned to earlier time periods.

Mines are the most commonly identified resource-procurement sites of this period. Again, there are undoubtedly a substantial number of resource-procurement sites formerly used by Native Americans that have not been recognized by archaeologists. Grinding implements and other traces of food-processing activities may provide us with clues as to where some resource-collecting places were located. Interviews with Native American cultural scholars offer another means of identifying these places in the modern landscape context.

No food-production sites from this time period have been specifically identified, despite the fact that we have ethnographic and historical documentation of these activities occurring in the river corridor at this time. It would be interesting to test the applicability of the soils-analysis approach at some of the locations where historical documentation indicates that farming occurred historically (e.g., near Beamer's Cabin and the mouth of Spring Canyon).

The salt mine below the mouth of the Little Colorado River is the only ritual location dating to this time period that has been recognized in the river corridor. Although its identification as a ritual site is based on oral traditions and ethnographic literature (e.g., Simmons 1942), this site, with its associated salt-encrusted prayer feathers, would have been readily recognizable to archaeologists as a ritual location from its material remains. However, other, less obvious ritual locations may not have been recognized during the river-corridor survey, given the emphasis that was placed on the presence of artifacts or features modified by humans in defining a site. The involvement of knowledgeable Native American traditional practioners is necessary for identifying these meaningful locations.

Trails are an important element of the historical-period landscape, as they were in all periods. Aboriginal trails underwent substantial modifications during this period to accommodate miners' pack stock. The Navajo made improvements to some routes in the eastern canyon to allow their sheep to access the inner-canyon benchlands and river corridor in Marble Canyon (Roberts et al. 1995). Widening of trails, reducing of grade, and the construction of masonry retaining walls and switchbacks are the most noticeable historical-period improvements to the trails. Modified historical-period trails correlate closely with the locations of mining activities within the inner canyon. Subsequent modifications to accommodate tourist traffic did not significantly alter this relationship, as only one trail in the Grand Canyon (the River Trail between South Kaibab and Bright Angel) was specifically created for tourists. Aboriginal routes that did not lead to mining locations were not significantly modified during the historical period. Most of these unimproved routes remain unknown to the general visiting public and, therefore, still retain many of their original prehistoric and protohistoric features.

During this period, historical inscriptions appear in the form of written Euroamerican names and dates on cliff faces and in rockshelters. In addition, Pai, Paiute, and Hopi people continued to create glyphs, often in association with places of ritual importance and usually in association with trails. Euroamerican glyphs are also found along trails, but, in addition, they occur in locations that are only accessible from the river, a reflection of the fact that boats had become an important mode of transportation during this period. The innovation of boat transportation within the river corridor is reflected in the distribution of other landmarks of this period, such as caches of river gear in otherwise inaccessible locations.

Definition of Property Types

Although it might be useful and beneficial to be able to organize the archaeological record of the Grand Canyon according to the five basic landmark categories defined by Zedeño (1997) and Whittlesey (1998), the nature of the resources, the state of their preservation, and the state of our current knowledge about Grand Canyon human history do not allow us to do this today in a meaningful way. In terms of the nature of the resources, for example, it is usually not possible to neatly categorize constellations of diverse traces that archaeologists call "sites" under single functional categories. In some instances, sites reflect distinctive cultural practices that included many separate functions at one location (habitation, food processing, ritual activity, etc.), whereas in other instances, sites reflect a palimpsest of several discrete functions carried out by members of different cultural groups at the same location over considerable spans of time. Thus, we may have sites that functioned as a habitation at one point in time and as a food-processing or ritual locale at another. Even when a site is the product of a single function carried out by a single culture within a very restricted time frame, it may not be possible to identify its function accurately when the site is buried 2 m under the ground or partially covered by shifting aeolian sand.

With regard to the final issue—our current state of knowledge—the accurate categorization of the various functions that were performed at specific locations in the past requires that we have a broad and more-or-less complete understanding of how and why people manipulated the space and materials around them to create certain configurations on the landscape. In the Grand Canyon, many of our current interpretations are based on analogies with similar cultures in places outside of the immediate area, and they may, or may not, be applicable to the unique setting in the river corridor. Furthermore, they may not be compatible with Native American interpretations of what happened at these locales.

Given these constraints, an archaeological-site typology for the river corridor that is culturally and functionally neutral and yet still relevant to analyzing landscape issues in a cross-cultural setting seems most appropriate to our aims here. Figure 59 and Table 3 portray a proposed property typology for the river corridor based on four key variables: occupational components (single or multiple), diversity of artifacts and/or features (high/low), presence or absence of spatially organized features, and the presence or absence of natural shelter. This scheme allows for the classification of 16 different site types embodying a wide variety of possible functional interpretations. The rationale for using this approach is discussed below.

Property Typology Rationale

Components: From a landscape perspective, it is desirable to know whether a site represents the activities of a single cultural group or the product of multiple cultural groups over time. The identification of occupational components is important for landscape analysis, because it helps us to separate those aspects of human behavior that are culturally bounded from those that may be shared by many, or all, cultural groups. It is the juxtaposition of single-component and multicomponent sites in a multilayered landscape that provides one means of distinguishing those aspects of human behavior that are culturally prescribed from those that derive from our common heritage as human beings.

The theoretical tenets of cultural determinism suggest that people from different cultural backgrounds gravitate to places within a given landscape because these locations provide the necessary attributes desired by humans for shelter, safety, water, and such. However, cultural values and culturally dictated needs may also be reflected in people's reuse of previously occupied locations, as, for example, when Hopi and Zuni revisit and leave offerings at ancestral homes, or when Navajo shamans obtain medicine objects from ancestral Puebloan ruins. In this respect, multicomponent sites may be considered in certain situations to be "embedded" landmarks. These "persistent places" (Schlanger 1992) serve as tangible points of historical reference in the larger landscape.

Ideally, we would like to be able to separate sites according to whether they were created by a single, specific-activity episode or by multiple, temporally discrete episodes, but given that this is rarely possible to determine through the surface analysis of archaeological remains, we must rely on the associated surface artifacts to place past activities in a more general temporal-cultural context, for example, Early Formative Pueblo, Late Formative Pueblo, or protohistoric Pai. In some instances, there may be sufficient breaks in the design styles of diagnostic artifacts to warrant a finer-grained separation (e.g., late Pueblo I and late Pueblo II), in which case it may be possible to distinguish separate occupational components of a single cultural group. Sites lacking culturally diagnostic artifacts or features must be assumed to be single component until further analysis suggests otherwise.

Artifact and/or Feature Diversity: Artifact diversity is generally assumed to reflect the range of human activities carried out at a specific location in the past. Although it may not be possible to know precisely what specific purposes or functions a given site may have served, it is usually possible to recognize if a very limited number of activities or a wide assortment of activities are represented at a given location, based on the types and diversity of associated remains. Sites where multiple activities took place often imply a longer residence time and/or a more centralized location within a given cultural system (e.g., "base camp"). For the purposes of this typology, we rely primarily on the number of different artifact categories

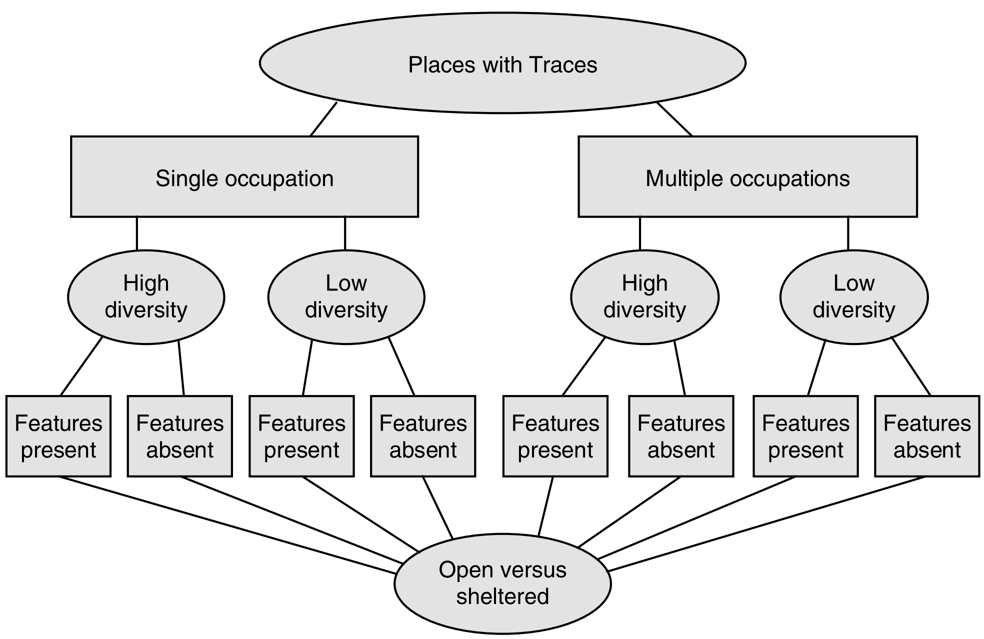

Figure 59. Proposed typology of property types for the Grand Canyon river corridor.

Table 3. Proposed Property Types for the Grand Canyon River Corridor

Type	Component	Artifact and/or Feature Diversity	Presence/Absence of Feature	Presence/Absence of Natural Shelter
Type 1	single component	high diversity	features present	sheltered
Type 2	single component	high diversity	features present	open
Type 3	single component	high diversity	features absent	sheltered
Type 4	single component	high diversity	features absent	open
Type 5	single component	low diversity	features present	sheltered
Type 6	single component	low diversity	features present	open
Type 7	single component	low diversity	features absent	sheltered
Type 8	single component	low diversity	features absent	open
Type 9	multicomponent	high diversity	features present	sheltered
Type 10	multicomponent	high diversity	features present	open
Type 11	multicomponent	high diversity	features absent	sheltered
Type 12	multicomponent	high diversity	features absent	open
Type 13	multicomponent	low diversity	features present	sheltered
Type 14	multicomponent	low diversity	features present	open
Type 15	multicomponent	low diversity	features absent	sheltered
Type 16	multicomponent	low diversity	features absent	open

(e.g., lithics, sherds, ground stone) or feature types (e.g., hearths, structures, glyphs) to define diversity. A site with one type of artifact (e.g., lithic debitage, but no ground stone) or a single type of feature (e.g., rock art) would be considered to have low diversity, whereas a site with sherds and lithics, or lithics and a roasting feature, would be considered to have comparably high diversity.

Presence/Absence of Features: This category refers to the presence or absence of constructions within a site (not necessarily just walled structures, but also cists, hearths, roasting pits, rock art, etc.) that may be spatially patterned according to specific cultural templates. In the United States today, it is usually possible to walk into a stranger's house, figure out where the kitchen is, and, after a few moments of trial and error, locate the eating utensils. This is because we share an unconscious template in our minds of how most Americans tend to organize their living space. All humans organize the space around them in one fashion or another. If the study of human history is concerned with elucidating both the patterns and processes of cultures and how and why they change, the analysis of spatially organized behavior is clearly a worthy pursuit in a multicultural landscape setting like the Grand Canyon. From a research standpoint, therefore, it is important to be able to distinguish those sites that have consciously constructed features from those that appear to be nothing more than an assortment of artifacts being moved around on the landscape by natural processes.

Presence/Absence of Natural Shelter: This last category reflects a primary landscape attraction that both influenced and constrained human settlement choices in the canyon. The attraction of shelters for habitation, storage, ritual, and other purposes crosscuts diverse cultural templates and leads people to select these locations repeatedly through time. Furthermore, from a strictly archaeological-research-value perspective, the distinction between sheltered and unsheltered locations is important in terms of identifying those locations where a much greater range of artifact types and a higher degree of preservation are likely to be encountered.

As an example of how different sites in the Grand Canyon might be characterized using this typology, consider the previously defined category of "roaster complex." In the original survey report (Fairley et al. 1994:13), this site type was defined as "two or more well-defined circular burned rock middens with or without associated discard piles, often but not necessarily associated with artifact scatters." Under the new typology, depending on whether artifacts were associated, and whether those artifacts reflected a single cultural-temporal period or multiple periods, we would define these sites as either single-component or multicomponent, single-activity or multiactivity, featured locations with or without associated shelters. As another example, consider a site in a shelter with multiple styles of rock art reflecting different cultural origins but no associated artifacts or structures. Under the proposed typology, this would be a Type 13 property (a multicomponent, low-diversity [single-activity], featured, sheltered location).

One obvious advantage of this typological approach is that it does not allow for a priori functional assumptions to be made without in-depth analysis and explicit, research-driven interpretation of the physical remains. This leaves the door open for the incorporation of diverse cultural opinions as to the meanings reflected in the remnants that we call "sites." An obvious disadvantage of this approach, however, is that the property-type labels do not convey much information about the associated materials constituting a given landmark. Therefore, it may be helpful to supplement the typological assignments with more-traditional, descriptive, but still functionally neutral labels when describing or discussing property types.

For the sake of expediency, a simplified list of "descriptors" (as opposed to site types) derived from the categories defined in the 1990–1991 inventory report is offered below as a supplementary source of basic descriptive information (Table 4). This list avoids the use of temporally or culturally specific labels, such as "pueblo" or "historical-period structure," and combines several of the previously defined site types (Fairley et al. 1994:12–13) into 14 discrete categories.

Note that some, although not necessarily all, of the descriptive types listed in Table 4 crosscut many of the property types in Table 3. It is possible, for example, for the S6 descriptor to occur with half of the newly defined property types (all those with features present). On the other hand, S7 could only occur with two property types (Type 7 or 8), depending on whether a vessel was in the open or in a sheltered setting. Keep in mind, however, that the 16 property types, not the attached descriptive label, take precedence. Temporal descriptors can also be added as needed for the purposes of future analysis. Although somewhat unwieldly, this approach to typology moves us away from the false functional assignments that so often pervade archaeological interpretations and closer to some of the key characteristics that define archaeological values in a landscape context and, to some extent, reflect traditional cultural values as well.

Property types that are based on components, artifact diversity, and the presence or absence of features and shelter are practical from several standpoints, but particularly because they readily allow archaeologists to identify sites that are most likely to contain the types of data best suited for answering certain research questions in a landscape context. For example, questions concerned with synchronic comparisons of material-culture attributes other than sherds and lithics (e.g., Questions II. B. 1, II. B. 5) will require data from contemporary single-component sites that either contain features (structures, rock art) or have shelters where perishable items are likely to be preserved. Questions concerned with documenting the frequency of paleofloods, on the other hand, or determining the relative predominance of aeolian processes in

Table 4. Proposed Supplementary Descriptive Labels

Label	Description
S1	substantial structure (combination of Site Types 1, 2, and 22)
S2	other structure (combination of Site Types 3–5)
S3	lithic scatter (same as Site Type 7)
S4	artifact scatter (combination of Site Types 6, 8, and 21)
S5	isolated thermal feature (same as Site Type 9)
S6	thermal feature(s) with artifacts (combination of Site Types 10 and 11)
S7	isolated pot (same as Site Type 12)
S8	burial (same as Site Type 13)
S10	isolated tools (combination of Site Types 14, 15, and 17)
S11	water/soil feature (same as Site Type 16)
S12	trail (same as Site Type 18)
S13	rock art/writing (combination of Site Types 19 and 20)
S14	other/unknown (combination of Site Types 23 and 99)

the past would be best answered by investigating multicomponent sites, because they can provide a view into the changing conditions experienced at one specific location over many centuries, with archaeological strata providing the necessary age control to help decipher the rates and timing of observed change. For broad questions, such as III. A. 1, an examination of both single-component and multicomponent sites that represent a broad spectrum of activities performed by multiple cultural entities in a wide variety of settings over time is needed. Thus, each property type has the potential to address a specific set of questions, but no single property type can answer the full suite of research questions pertaining to the changing interrelationships between land, people, and landscapes over time. Developing a comprehensive understanding of the Grand Canyon's landscape history requires that we consider data from a broad array of sites. Thus, all of the defined property types have the potential to contain important information about the past and should therefore be considered potentially significant under Criterion d. The question of whether or not a particular resource is, in fact, significant under Criterion d therefore turns on the issue of whether or not it retains sufficient integrity to convey its significance within a landscape context. In a dynamic environment like the Grand Canyon river corridor, the issue of integrity can only be resolved through a program of intensive testing and evaluation on a site-by-site basis.

Prioritizing Landmarks for Future Study

The primary purpose of developing a research design is to provide a framework for focusing future scientific research. In most cases today, archaeological research designs are typically organized around a specific theoretical model. For this particular research design, we have taken a somewhat different approach. Building on the previous models developed by Whittlesey (1998), Bischoff et al. (2000), Zedeño (1997), and others, we have used a landscape approach to derive a series of research themes and research questions, rather than following an explicitly theoretical orientation. The landscape approach seemed most appropriate in this instance because of the diverse cultural interests that are attached to the Grand Canyon and have been expressed through the Section 106 PA within the ongoing Glen Canyon Dam Adaptive Management Program. Furthermore, the landscape approach is well suited to the integration of information from different areas within the river corridor, as well as from multiple disciplines. This is important for the integration of future archaeological research results within a broad ecosystem framework, which forms the cornerstone of the current Adaptive Management Program.

Typically, research questions and identified data needs determine which historic properties should be selected for future study in a data-recovery program. In the case of the Grand Canyon river corridor, however, the terms of the PA among Reclamation, the NPS, the Arizona SHPO, the ACHP, and the six tribal entities mandate a more inclusive approach to prioritizing future sites for data recovery. The mandates of the NPS to conserve places for the benefit and enjoyment of future generations, in concert with the traditional cultural mandates of the various tribes whose history is embedded in the Grand Canyon, require us to consider factors other than pure research interests when selecting sites for future data recovery. It should be noted, however, that NPS policy does not preclude the option of conducting data recovery for the purposes of improving our understanding about the past. In fact, NPS policy explicitly permits archaeological data recovery "if justified by research or interpretation needs" (NPS 2001:55.)

In response to the original RFP, we originally proposed to prioritize sites for future treatment based on a cluster analysis of ranked variables such as traditional importance, rarity, research values, and integrity. Upon further consideration of the available information, it became apparent that this approach would not work. Two principal factors led to this conclusion. First, Native American consultants had not and would not participate in the process, referred to by Stoffle and Evans (1990) as "cultural triage," of ranking sites of traditional importance in any fashion. Second, the integrity of most sites in the river corridor could not be determined from surface evidence alone and would have required an extensive testing process that was well beyond the scope of this project.

Until now, data recovery under the existing PA program has been driven entirely by visual assessments to determine which sites appear to be undergoing the most severe erosion. In other words, current data-recovery efforts are driven predominantly by the need to "salvage" information before it is lost forever, rather than by a desire to understand specific aspects of prehistory or to answer important questions about the past. Furthermore, these salvage excavations have been limited to parts of eroding features at these sites, supplemented with small, randomly placed "test units." The term "data recovery" is really a misnomer in these instances; testing is the term more commonly used for these kinds of excavation efforts in other parts of the Southwest.

On the surface, the current emphasis on excavating only those sites that are most threatened by erosion seems logical in light of Native American concerns about the significance of the Grand Canyon and its many landmarks. Whether the erosion of sites is being caused exclusively by dam operations or not, sites that are not actively eroding are clearly not being affected by dam operations, at least not yet. And although all tribes do not agree about the need to excavate sites, and some question the potential value of the information that may be obtained from this work, they certainly all seem to agree that excavations should not be undertaken at sites that are not in imminent danger of disappearing from the landscape.

Within these general parameters, many different kinds of sites are being dissected by river-based arroyos, and these sites are the ones most likely to disappear or lose integrity in the near future (Hereford et al. 1993; Thompson and Potochnik 2000). One serious problem with the current piecemeal approach to data recovery is that as sites continue to erode, more features will become exposed, become unstable, and require excavation. As currently designed, the Remedial Action Plan (NPS 1994) guiding the management of cultural resources in the river corridor is structured so that sites may be incrementally excavated, feature by feature, in perpetuity.

In the future, decisions will need to be made about which sites should be excavated and which should be left alone. Discussions in Chapter 6 and the brief preceding summary of landscape attributes through time have pointed out many pieces of the cultural landscape story that remain unknown or poorly known. Ideally, these data gaps should be used to determine which of the many eroding sites in the Grand Canyon should receive attention from archaeologists in the near future. If excavations are going to happen anyway, it would seem preferable, from both a scientific and a traditional cultural perspective, to select a sample of threatened sites that is likely to contribute important information and excavate those extensively, rather than conduct an infinite number of minor excavations—sometimes at the same sites again and again. The proposed property typology provides a list of site categories that could be used to structure the sample in order to retrieve a wide array of data relevant to furthering our understanding of the land, the people, and the evolution of landscapes in the river corridor over time. This approach would be more informative, efficient, and respectful of the important values that these sites contain than one that focuses exclusively on salvaging bits and pieces of already eroded individual features, irrespective of their research potential or traditional cultural value.

The predictive model developed by Thompson and Potochnik (2000) offers a preliminary means of identifying those sites most likely to undergo erosion in the foreseeable future. A somewhat different approach to geomorphic modeling by Pederson (2000) shows additional promise as a means of predicting site erosion in the future. The latter approach may prove to be particularly useful in identifying specific areas of sites that are most likely to be subjected to gullying in the future and prioritizing them for future data recovery of one kind or another. Using geomorphic models, it should be possible to identify and target those sites that have the greatest likelihood of disappearing in the near future and focus data recovery efforts accordingly.

Methodological Issues and Guidelines

A troubling aspect of the current approach to data recovery in the river corridor, aside from the fact that it has not been driven by any explicit research framework or important research questions, is that the excavations have not been conducted in a manner that provides sufficient contextual information for the purposes of future analysis and interpretation. Hearths have been excavated that seem to float in space and cross-sectional profiles have been drawn that are not linked with any specific cultural features or the geomorphic landscape as a whole. Future excavations need to be undertaken in a manner that allows the resulting data to be placed in a meaningful spatial-geomorphic and temporal-cultural context within the overall site setting. This does not necessarily mean that whole sites have to be excavated, but the excavations should include a contiguous area of sufficient size to provide a meaningful stratigraphic and cultural context for the proper interpretation of recovered remains.

Using the Property Type categories listed in Table 3 as a framework, we need to devise site-specific data-recovery approaches that will provide the most useful, interpretable results over the long run. For example, if a single roasting feature is proposed for data recovery and it occurs within a low-diversity, single-component site, the feature needs to be excavated and documented in a manner that allows it to be interpreted within a holistic site context, because this feature may be the main source, if not the only source, of archaeological information at the site. On the other hand, if the feature occurs in a large, dispersed, multicomponent setting, a whole-site approach may not be feasible. Nevertheless, the targeted feature needs to analyzed with reference to its surrounding stratigraphy and associated cultural setting (both surface and subsurface), so that its relationship to other features of similar age can be defined, as well as its relationship to earlier or later remains that may be present nearby. Low-diversity sites without features may not warrant subsurface excavation at all, but they may still have important information to contribute by way of their artifacts and spatial settings.

In addition to devising data-recovery strategies that will allow us to interpret individual features in relation to their site context, we need to ensure that these features are documented in a manner that permits their comparative analysis across the entire river corridor and over multiple time periods. As noted by Yeatts (2000:15), if future data recovery is limited to salvaging individual features, rather than exploring them in a holistic site context,

> we are in effect forcing the research focus to a larger, inter-site or regional level. In order to make this approach viable, however, specific regional research questions need to be developed [and then] a commitment to collect comparable types of information from locations throughout the River Corridor that are appropriate to address specific research (likely long term) questions must be made. . . . Finally, and this is the critical step in long term research, the data must be analyzed with regard to the research questions as the relevant information becomes available. *Without this final step, the collection of the data is truly a wasted effort* [emphasis added].

This research design has not been limited to research themes and questions that are only applicable to a feature-based excavation strategy, because data recovery can take many forms. Furthermore, and perhaps most important, there are numerous important research questions that cannot be addressed by conducting only feature-based excavations. For example, if we want to understand how different cultures organized themselves spatially within a landscape context, we need to be able to examine the relationships between groups of contemporary features within a specific localized setting. If we want to understand the nature of past relationships between different contemporaneous cultural groups, we need to be able to compare and contrast more than the ages and forms of individual eroding hearths.

The specific forms of future site treatments and the strategies for future data recovery in the river corridor remain to be determined through the PA process and the development of a specific treatment plan. Many of the research themes have specific questions attached to them that could be suitably addressed through feature-based excavations provided that the data are gathered, analyzed, and stored in a manner that allows intrasite and intersite comparisons and regional-scale interpretations to be made in a meaningful way in the distant future. Future treatment plans, whether site specific or corridor wide, need to specify how the data will be collected, analyzed, interpreted, and stored in a database so as to permit comparisons of archaeological remains from many different site settings over the long term. Most important, there needs to be an explicit commitment from the responsible agencies to synthesize and interpret the data collected during any future mitigation program. Otherwise, as Yeatts has noted, the data-recovery effort is a waste of time and money. More significantly, it is a waste of valued and irreplaceable cultural resources.

In addition to excavating the sites that were recorded during the inventory survey, the landscape approach dictates that we should also study nonsite areas ("places without visible traces"), specifically those areas that may contain information relating to food production (e.g., fields), as well as other places that may be helpful in reconstructing paleoenvironmental conditions over time. For example, the area in which Davis et al. (2000) recovered corn pollen bracketed by Preformative radiocarbon dates was not identified as an archaeological site during the 1990–1991 survey. Davis chose to investigate this location mainly because of its soil characteristics and because carbon layers exposed in nearby gullies offered an opportunity to date the soil horizons. Nonsite areas may also be researched in terms of their meanings and importance to Native Americans and other communities with long-standing ties to the river-corridor landscape (i.e., river runners.) Appropriate data-recovery methods at traditional cultural locations may include mapping for future GIS analysis purposes, photo-documentation, conducting interviews, and recording oral traditions.

Moving Beyond Excavations

Sites that are actively eroding, but which are determined to be unsuitable for excavation for one reason or another, can still contribute valuable and important information relevant to this research design and the goals of the Glen Canyon Dam Adaptive Management Program. For example, there may be some real research value in simply watching (and systematically documenting) some sites as they erode. Despite the amount of time, effort, and money that has been spent monitoring sites in the river corridor, we still know relatively little about the specific mechanisms of site erosion and the factors that contribute to it. Do sites erode differentially under the same conditions, and, if so, why? Do sites erode incrementally or does most erosion happen catastrophically? Are there specific trigger points that result in a dramatic change in the rate of erosion? Do sites erode more rapidly when the river is flowing at certain stages or within a specific stage range, all other factors being equal? Redesigning the monitoring program to serve as a research vehicle could lead to new insights about the mechanisms that have altered sites not only in the present, but in the past as well.

The key point to keep in mind is that data recovery can take many forms. Archaeological excavation is just one approach. There are many other options for data recovery that do not require subsurface disturbance of sites. Oral interviews with Native American scholars (to provide emic contexts for reconstructing cultural landscapes), spatial analyses of artifact distributions (both intrasite and across the entire corridor landscape), rock-art documentation and analysis, GIS analysis of both ethnographically and archaeologically derived information, and mineral and clay sourcing of existing collections are just some of the many ways that valuable data could be recovered from river-corridor sites without causing further disturbance to them.

From an archaeological perspective, the ideal would be to employ a variety of data-recovery approaches. For example, an analysis of perishables previously recovered from sheltered sites in the river corridor could potentially be undertaken using standard nondestructive textile-analysis techniques. Modern Native American basketmakers could contribute to this study by sharing their traditional basketmaking knowledge with the analysts, some of whom could be descendants of those who had made the artifacts. Modern basketmakers could contribute information about where, when, and how basketry materials are collected, thereby adding to our understanding of how similar places in the river corridor may have been used in the past. Such a study would contribute both to the field of archaeology and to the perpetuation of traditional knowledge. A combination of oral interviews, artifact analyses of existing collections, and well-conceived, carefully executed excavations would probably provide the richest return for an investment of time and money, and would allow us to not only meet Section 106 legal obligations but would substantially expand our current understanding of the Grand Canyon's complex and fascinating human story.

Concluding Thoughts

Landscapes are, by definition, multidimensional phenomena. At the most basic level, their existence requires the intersection of time, space, physical matter, and physical and cultural processes, in addition to one or more layers of human interpretation. In order to be able to learn from and appreciate landscapes as multidimensional phenomena, we need to be able to look at them from many points of view and use many different scales. This research design has been structured to allow archaeologists and others with an interest in the human history of the Grand Canyon to think about, study, and appreciate the Grand Canyon landscape holistically by using various scales of analysis and incorporating a variety of cultural perspectives. A multidimensional approach rather than a single-minded theoretical one has been chosen for this research design in order to make sense of the full spectrum of values and issues that are attached to and influence the management of this unique place.

Landscape scales of analysis can range from single points in time and space to multidimensional overviews. Data accumulated as single points must be placed in broader contexts in order to be meaningful and valuable for landscape-level analysis, otherwise the data are nothing more than scattered bits of information floating in space. To be meaningful and valuable for both western science and traditional forms of Native American knowledge, land-based information about the human past in the Grand Canyon needs to be tied empirically to the larger ecological setting of which it forms a part (Sullivan et al. 1999).

To be placed in a landscape context means more than pinpointing an item or place in space and time and then assigning it a name or number, although for the purposes of scientific analysis, this is an important step that needs to be performed accurately. It also means more than putting an item or place into a historic context, although for the purposes of compliance with the NHPA, this is an essential step to take in order to be able to assess a given property's historic value in accordance with Euromerican value systems and U.S. law. In this research design, however, we have taken a much broader view of context. We suggest that context means not only the four dimensions of space and time overlain with historical themes, but that the themes themselves are multidimensional for any given place we may choose to consider. Putting places and items into the broader context of landscape requires not only defining the physical and historical dimensions, but also requires incorporating the values and meanings that are ascribed to a given place by the many different cultures whose history and traditions are embedded within it.

The Grand Canyon is recognized as a World Heritage site not only because of its rich and varied physical attributes, but because it serves as a cultural icon for this country and for the international community as a whole. For the various Native American people with diverse cultural backgrounds who once lived within its walls, the Grand Canyon has special and specific cultural meanings that are different from, but no less worthy than, those applied by the dominant western society. Indeed, some might argue that indigenous values should take precedence, given that it is primarily indigenous people who have resided in and are buried within the Grand Canyon. Be that as it may, the Grand Canyon today is greatly valued by a diverse assortment of people from all over the world and for many different reasons. It therefore behooves us to study and attempt to understand its diverse cultural values with this in mind.

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